Over 150 AC Induction Electric Motor Drawings & Connections

3 & Single Phase
Single & Multi-Voltage
18 to 120 Slot
2 to 12 Pole
Two Speed:
4 / 2, 8 / 4, 12 / 6 Pole
Rotor Windings Lap & Wave

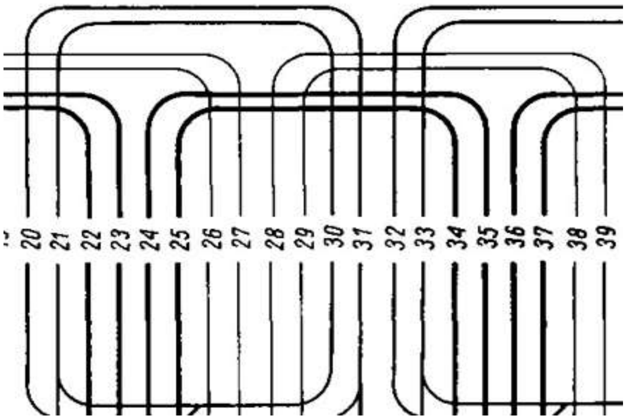
Index

	Page Number
Connection Translations Polish to English	***3***
Winding Recognition of Electric motors	***4***
Winding Diagrams / Connections Selection Key	***8***
Two and Three Tier Windings	***11***
Concentric / Chain Group Windings	***28***
Basket Windings	***58***
Double Layer Lap Windings ***Double Layer Lap Winding with Full / Half Coils*** ***Double Layer Lap Windings with Odd Groups*** ***Double Layer Lap Windings with Split Groups*** ***Double Layer Lap Winding with Split and odd Groups*** ***Concentric Double Layer Winding*** ***Concentric Double Layer Winding with Full / Half Coils*** ***Concentric Double Layer Windings with Odd Groups*** ***Concentric Double Layer Winding with Split Groups*** ***Concentric Double Layer Winding with Split and odd Groups***	***63***
Rotor Windings Lap ***Rotor Windings Wave***	**119**
Two Speed Windings	**150**
Multi-voltage Winding	**154**
Single Phase Winding	**156**
Blank Page	**178**

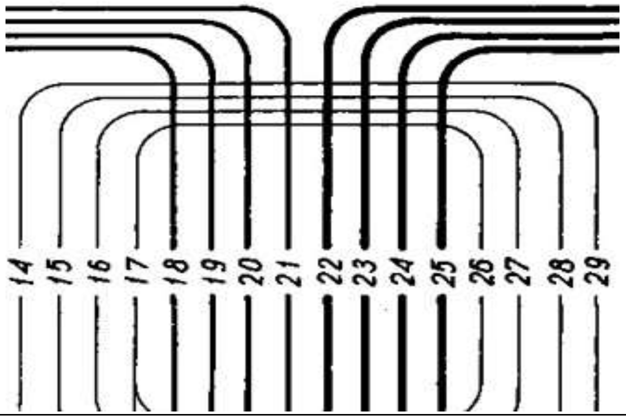
Connection Translations

Dwa obwody równoległe	Two Parallel Path
Cztery obwody równoległe	Four Parallel Path
Trzy obwody rownolegte	Three Parallel Path
Łączenie szeregowe	Series Connection
⅄ Połączenie szeregowe	Series Star
Pięć obwodów równoległych	Five Parallel Path
△△ 110V. Trójkąt, dwa obwody równoległe	Two Parallel Delta
⅄⅄ 190V. Gwiazda, dwa obwody równoległe	Two Parallel Star
△ 220V. Trójkąt, łączenie szeregowe	Series Delta
⅄ 380V. Gwiazda, łączenie szeregowe	Series Star
Taczenie tabliczki zaciskowej na rozne napiecia	Connecting the terminal plate into different voltages

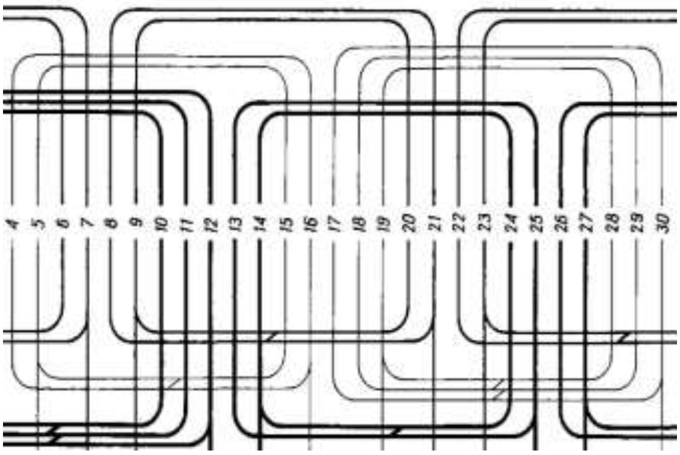
Winding Recognition of Electric motors



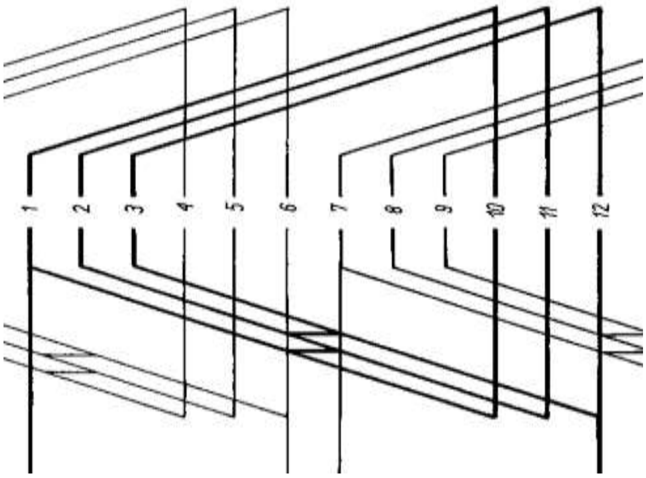
(A) **Three-Tier**, Each Tier is one phase. Can also be fitted progressively see Concentric Chain Group



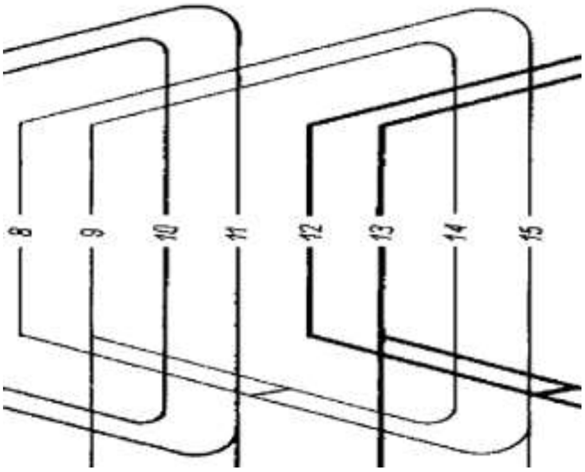
(B) **Two Tier.** Can also be fitted progressively see Concentric Chain Group



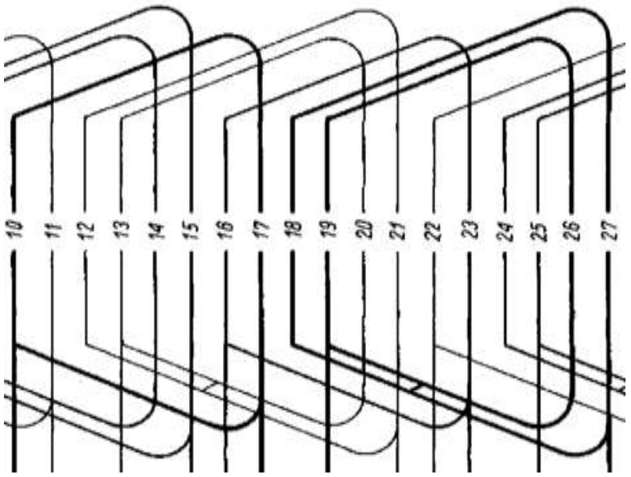
(A1) Three-Tier With odd Grouping



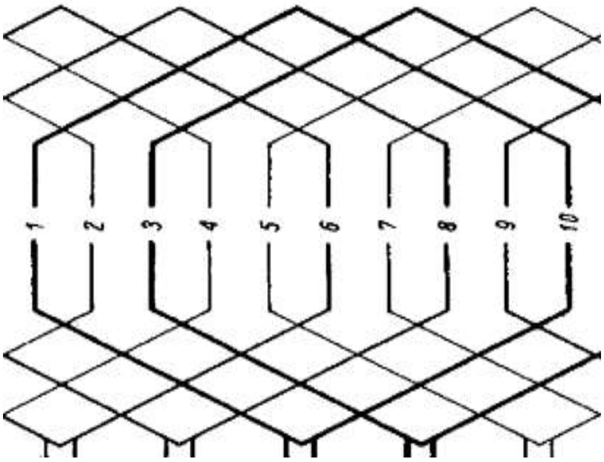
(C) **Chain Group**, fit groups progressively



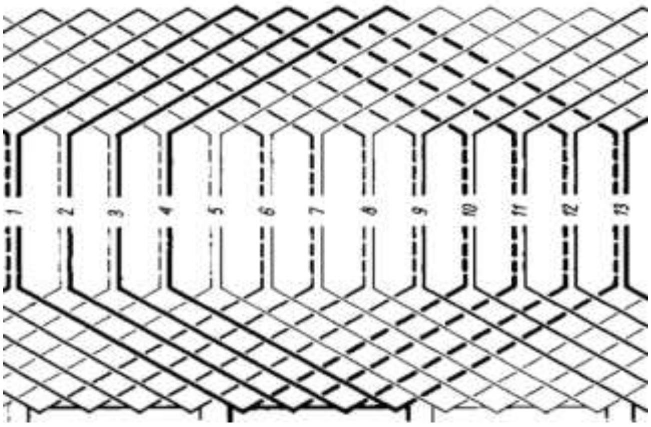
(D) **Concentric Chain Group**, fit groups progressively



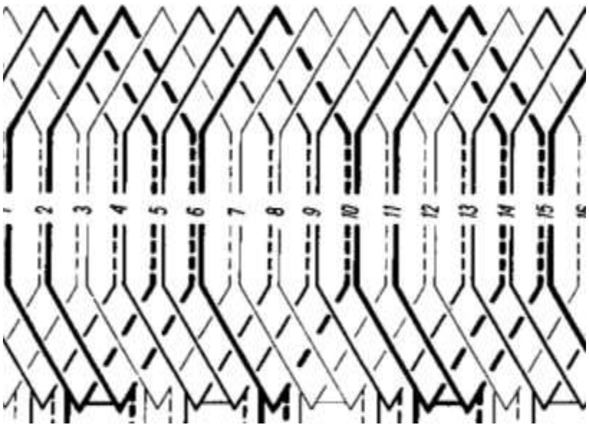
(E) Concentric Chain Group, with odd grouping. Fit groups progressively



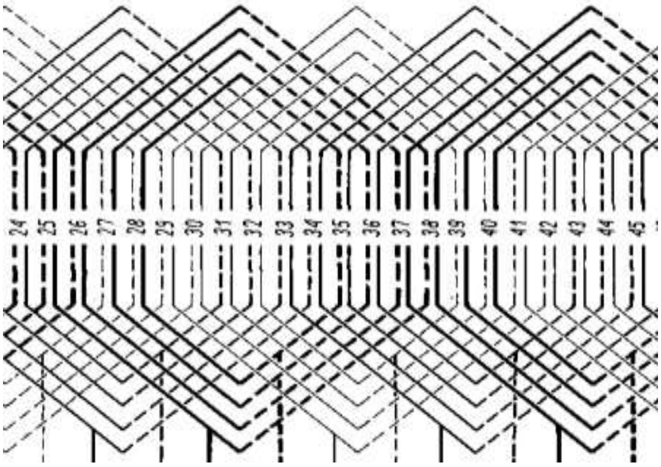
(F) Basket Winding, single coils, single pitch. Fit groups progressively



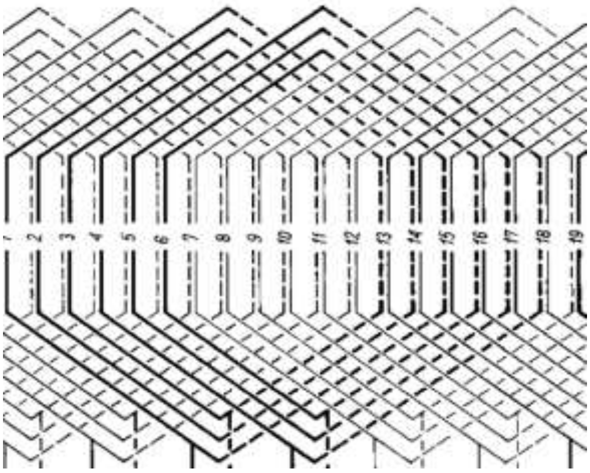
(G) Double Layer Lap sometimes called 2-layer lap or ½ coil. Fit groups progressively.



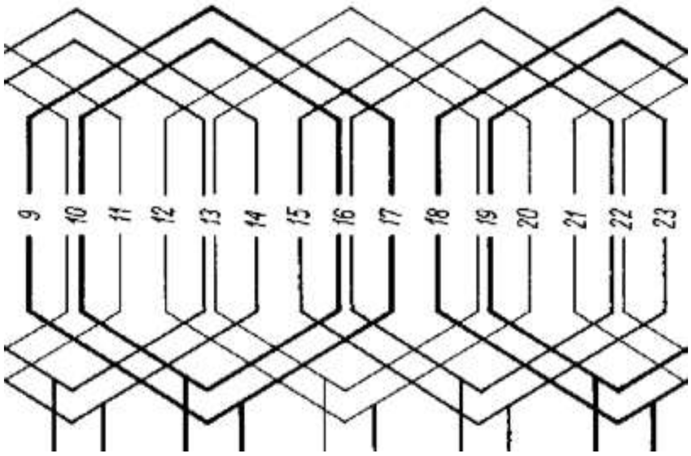
(H) Double Layer Lap with odd coil grouping. Fit groups progressively.



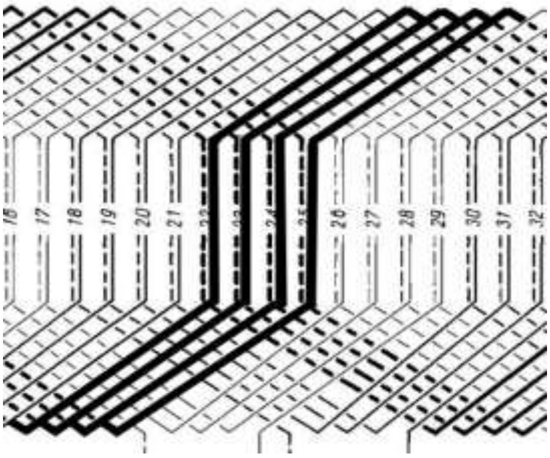
(I) Concentric Double Layer. Fit groups progressively.



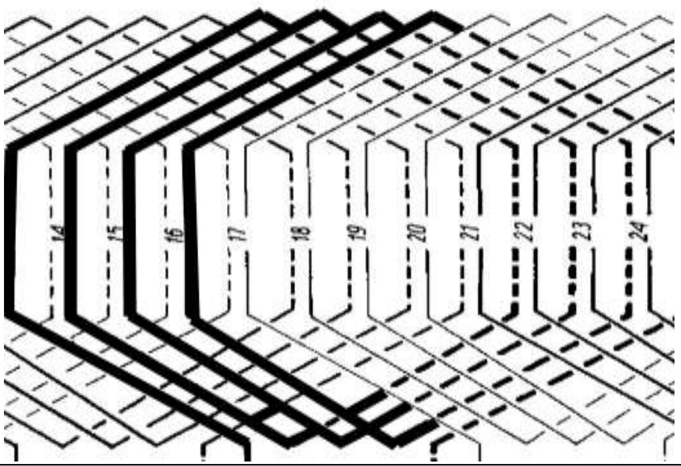
(J) Concentric Double Layer, with split groups, Fit groups progressively.



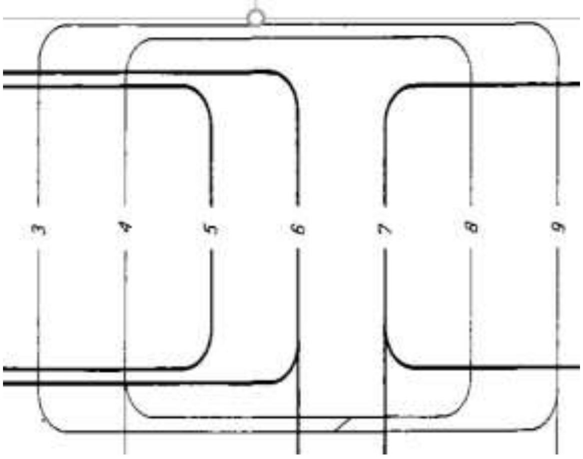
(K) **Three Tier Full / Half Coil**, Each Tier is one phase. Can also be fitted progressively see Concentric Chain Group



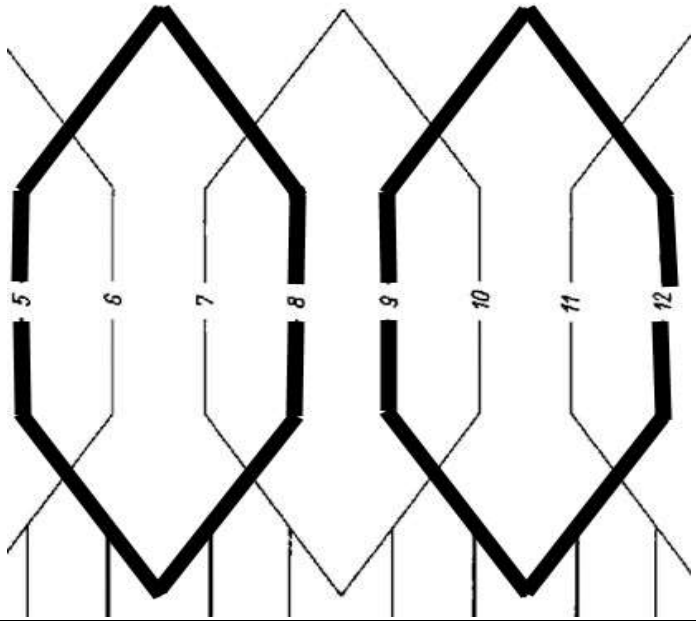
(L) Rotor Winding (Wave)



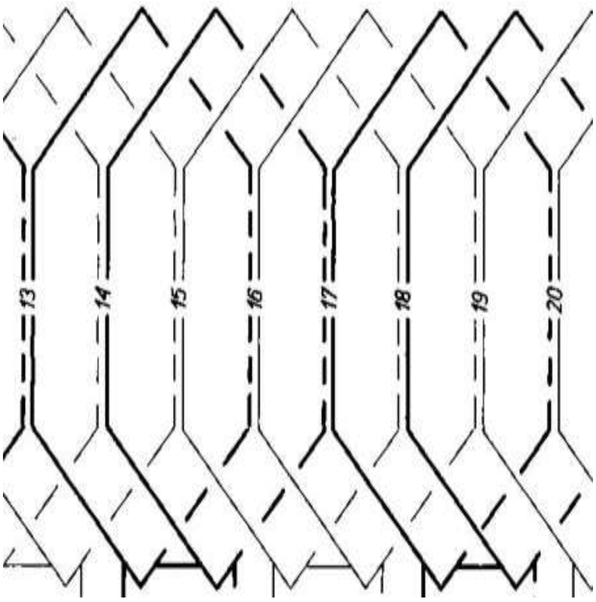
(M) Rotor Winding (Lap)



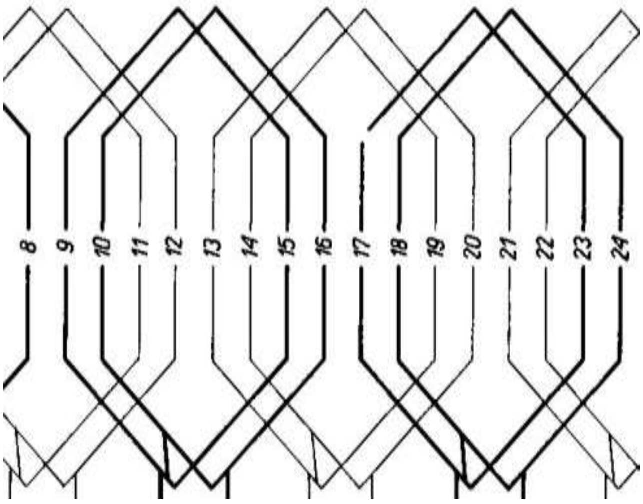
(N) Two Tier, Single Phase Winding



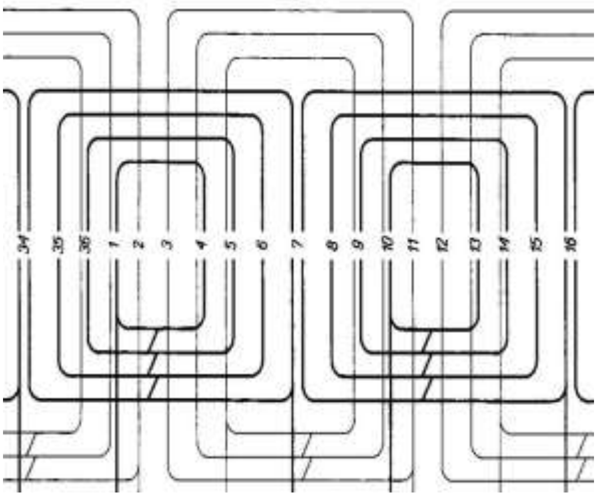
(O) Basket Two-Phase Winding



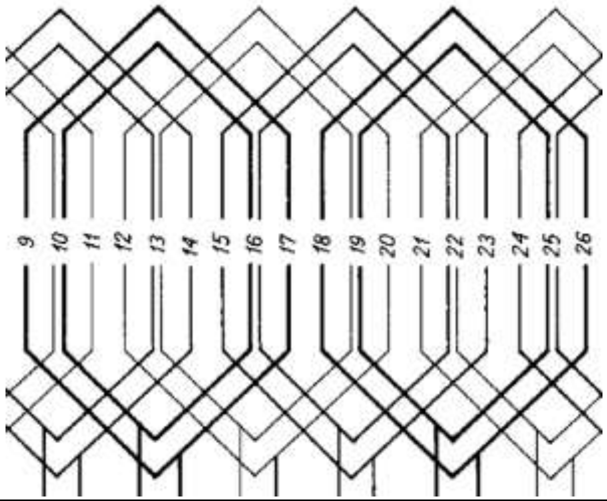
(P) Double-Layer Lap Single Phase Winding



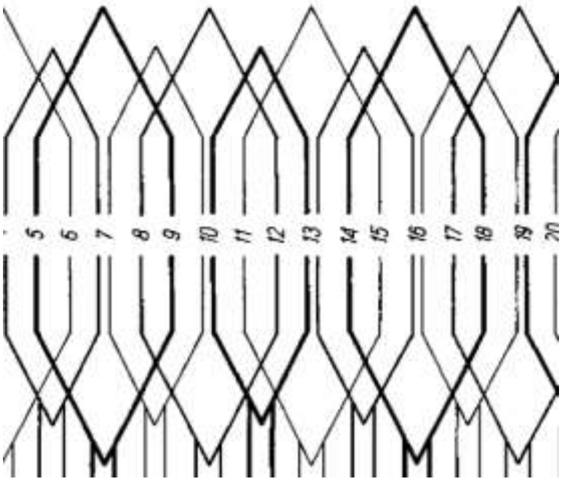
(Q) Chain Group Single Phase Winding



(R) Sine Wave, Two Tier, Single Phase Winding



(S) Concentric Full / Half Coil (1/2 Coil on Inside Group)



(T) Full / Half Coil with odd Pitches

Winding Diagrams / Connections Selection Key

A – Three-Tier
A1 - Three-Tier With odd Grouping
B – Two Tier
C - Chain Group
D - Concentric Chain Group
E - Concentric Chain Group, with odd grouping
F – Basket
G - Double Layer Lap
H - Double Layer Lap with odd coil grouping
I - Concentric Double Layer
J - Concentric Double Layer, with split groups
K - Three Tier Full / Half Coil
L - Rotor Winding (Wave)
M - Rotor Winding (Lap)
N - Two Tier, Single Phase
O - Basket Two-Phase
P - Double-Layer Lap Single Phase
Q - Chain Group Single Phase
R - Sine Wave, Two Tier, Single Phase
S - Concentric Full / Half Coil (1/2 Coil Inside Group)
T - Full / Half Coil with odd Pitches

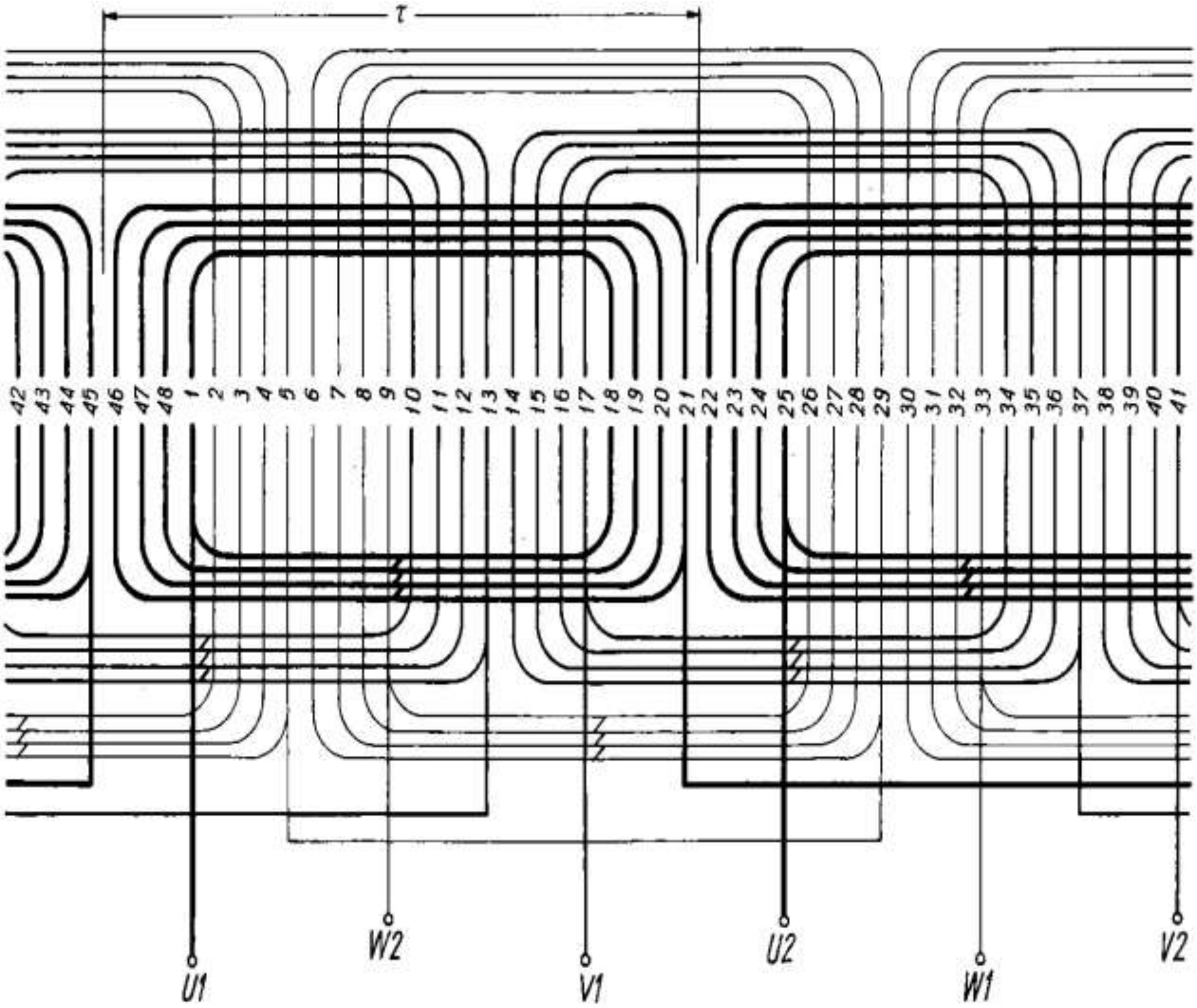
Slots	Poles	Type	Fig.	Page	Comments	Slots	Poles	Type	Fig.	Page	Comments
18	2	D	33	28		36	4	G	74	75	
"	2	E	33a	28		"	4	I	74a	76	
"	2	D	33b	29		"	4	S	74b	77	
"	2	L	102	119		"	4	G	75	78	
"	2	M	103	119		"	4	I	75a	79	
"	4	L	104	120		"	4	G	146	155	Multi-Voltage
24	2	D	34	29		"	4	L	113	124	
"	2	D	34a	30		"	8/4	G	141	151	
"	2	C	35	30		"	8/4	I	141a	152	
"	2	F	61	58		"	6	D	42	38	
"	2	G	66	62		"	6	C	43	39	
"	2	I	66a	63		"	6	F	64	60	
"	2	J	66b	64		"	6	G	76	80	
"	2	G	67	65		"	6	I	76a	81	
"	2	G	145	154	Multi-Voltage	"	6	G	77	82	
"	2	L	105	120		"	6	L	114	125	
"	2	M	106	121		"	12/6	G	142	152	
"	4/2	G	139	150		"	8	E	44	40	
"	4	C	36	31		"	8	F	44a	41	
"	4	C	37	32		"	8	F	64a	60	
"	4	F	62	59		"	8	I	78	83	
"	4	G	68	66		"	8	I	78a	84	
"	4	G	68a	67		"	8	T	78b	85	
"	4	L	107	121		42	4	L	115	126	
"	6	H	69	68	Asymmetrical	48	2	A	16	11	
30	2	L	108	122		"	2	A	17	12	
"	2	M	109	122		"	2	D	45	42	
"	4	L	110	123		"	2	C	46	43	
36	2	D	38	33		"	2	G	79	86	
"	2	C	39	34		"	2	G	80	89	
"	2	F	63	59		"	2	G	81	90	
"	2	G	70	68		"	2	L	116	127	
"	2	J	70a	69		"	2	M	117	128	
"	2	G	71	70		"	4/2	G	143	153	

Slots	Poles	Type	Fig.	Page	Comments	Slots	Poles	Type	Fig.	Page	Comments
36	2	G	71a	71		"	4	B	18	11	
"	2	G	72	72		"	4	A	19	13	
"	2	J	72a	74		"	4	D	47	44	
"	2	G	73	74							
"	2	L	111	123		"	4	D	48	45	
"	2	M	112	124		"	4	C	49	46	
"	4/2	G	140	150		"	4	G	82	91	
"	4/2	G	140a	151		"	4	K	82a	92	
"	4	D	40	35		"	4	G	83	93	
"	4	E	40a	36		"	4	I	83a	94	
"	4	C	41	37		"	4	G	84	95	
48	8/4	G	144	153		63	6	B	127	138	
"	6	H	85	96	Asymmetrical	72	4	A	26	20	
"	8	B	20	14		"	4	D	56	53	
"	8	D	50	47		"	4	G	95	109	
"	8	F	65	61		"	4	L	128	139	
"	8	G	86	97		"	6	B	27	21	Crank Coil
"	8	I	86a	98		"	6	A	28	22	
"	8	L	119	130		"	6	D	57	54	
54	2	L	120	131		"	6	G	96	110	
"	2	M	121	132		"	6	G	97	111	
"	4	A1	21	15		"	6	I	97a	112	
"	4	E	51	48		"	6	L	129	140	
"	4	H	87	99		"	8	B	29	23	
"	4	L	122	133		"	8	A1	30	24	
"	6	B	22	16	Crank Coil	"	8	D	58	55	
"	6	A1	23	17		"	8	G	98	113	
"	6	D	52	49		"	8	I	98a	114	
"	6	D	53	50		"	8	G	99	115	
"	6	G	88	100		"	8	G	99a	116	
"	6	I	88a	101		84	4	L	130	141	
"	6	G	89	102		90	4	L	131	142	
"	6	L	123	134		"	6	A1	31	25	
"	8	H	90	103		"	6	E	59	56	
60	4	A	24	18		"	6	G	100	117	
"	4	E	54	51		"	6	L	132	143	
"	4	G	91	104		"	10	B	32	26	Crank Coil
"	4	I	91a	105		"	10	A	32a	27	
"	4	G	92	106		"	10	D	60	57	
"	4	L	124	135		"	10	G	101	118	
"	6	M	125	136	asymmetrically	"	10	L	133	144	
"	8	B	25	19		96	8	L	134	148	
"	8	E	55	52		108	6	L	135	146	
"	8	H	93	107		"	8	L	136	147	
"	8	H	94	108		120	8	L	137	151	
"	8	L	126	137		"	10	L	138	149	

Schemes of single-phase motor Winding

Slots	Poles	Type	Fig.	Page	Comments	Slots	Poles	Type	Fig.	Page	Comments
12	2	N	147	156		24	4	R	169	172	
"	2	N	161	169		"	6	P	154	161	
16	2	N	148	160		"	6	O	155	162	
"	4	O	149	157		28	4	N	170	172	
18	2	N	162	166		32	4	Q	156	162	
"	2	N	163	167		"	4	P	157	163	
"	2	R	164	167		"	4	N	171	173	
24	2	N	150	158		"	4	R	172	173	
"	2	P	151	159		"	8	O	158	163	
"	2	P	165	168		36	4	N	173	174	
"	2	N	166	169		"	4	R	174	175	
"	4	N	152	160		"	6	N	159	164	
"	4	P	153	160		"	6	P	160	165	
"	4	N	167	170		"	6	N	175	176	
"	4	P	168	170		48	6	R	176	177	

Two & Three Tier Winding



Dwa obwody równoległe

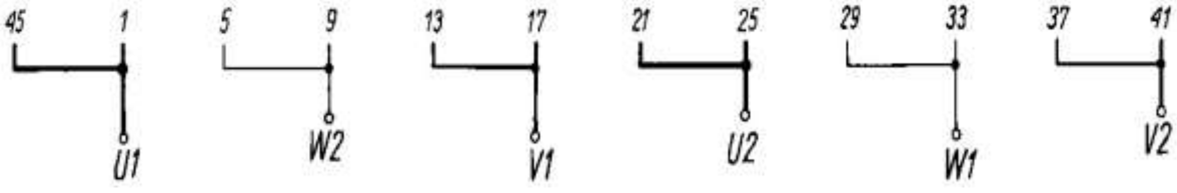


Figure. 16. Three-Tier Winding
Slots = 48; Poles = 2; y = 17, 19, 21, 23; g = 8

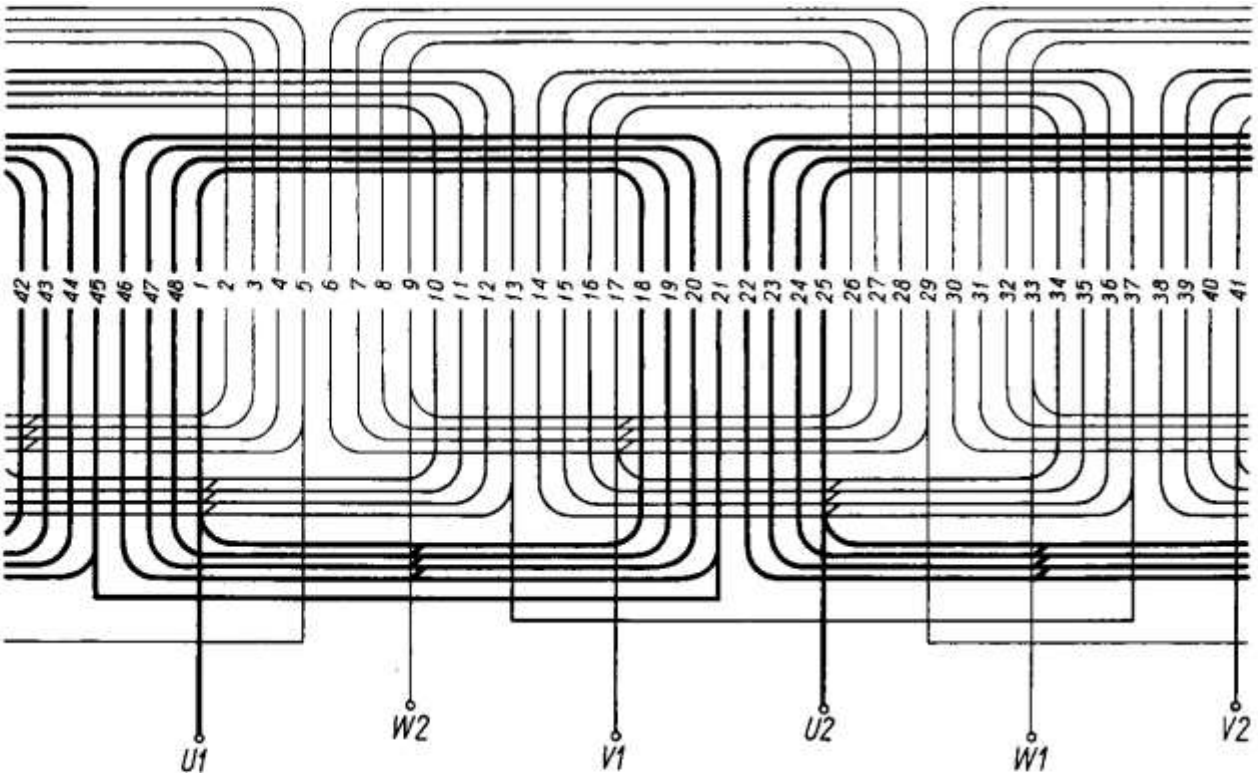
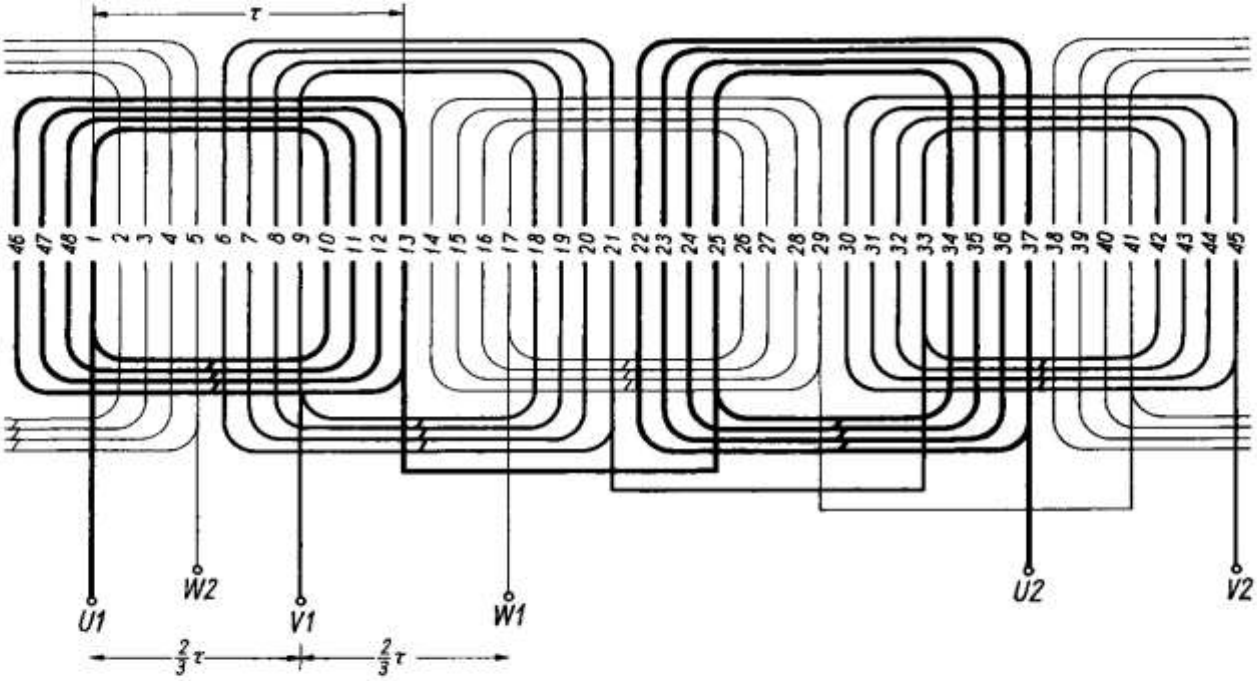


Figure. 17. Three-Tier Winding
Slots = 48; Poles = 2; y = 17, 19, 21, 23; q = 8



Dwa obwody równoległe

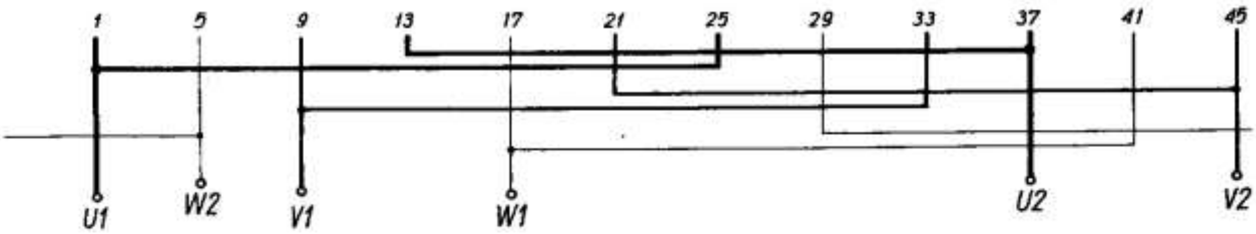
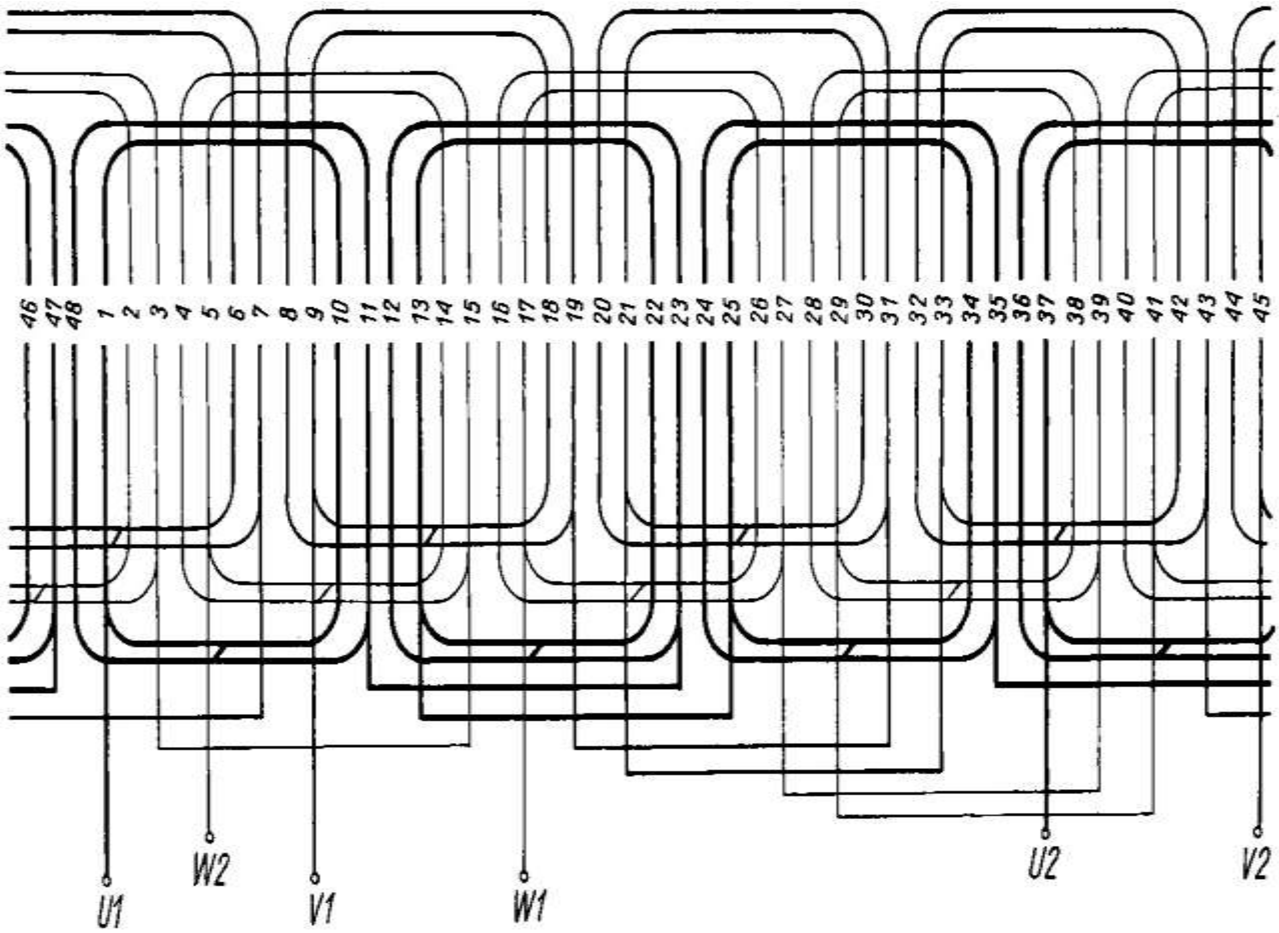


Figure. 18. Two-Tier Winding
Slots = 48; Poles = 4; y = 9, 11, 13, 15; q = 4



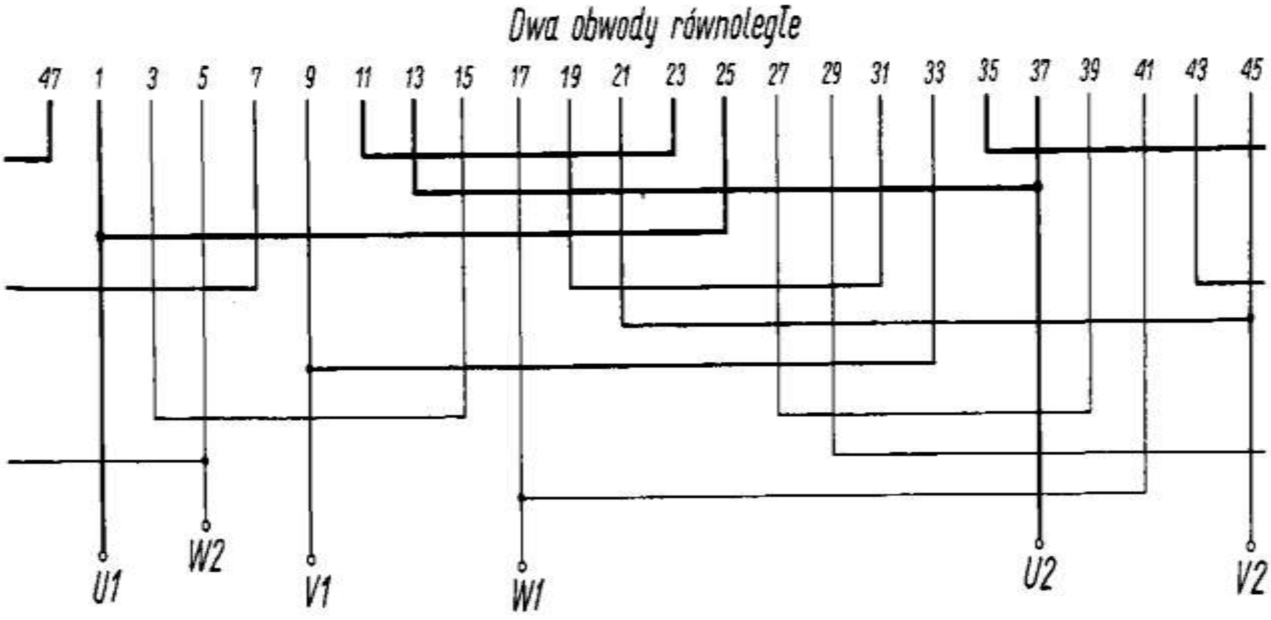
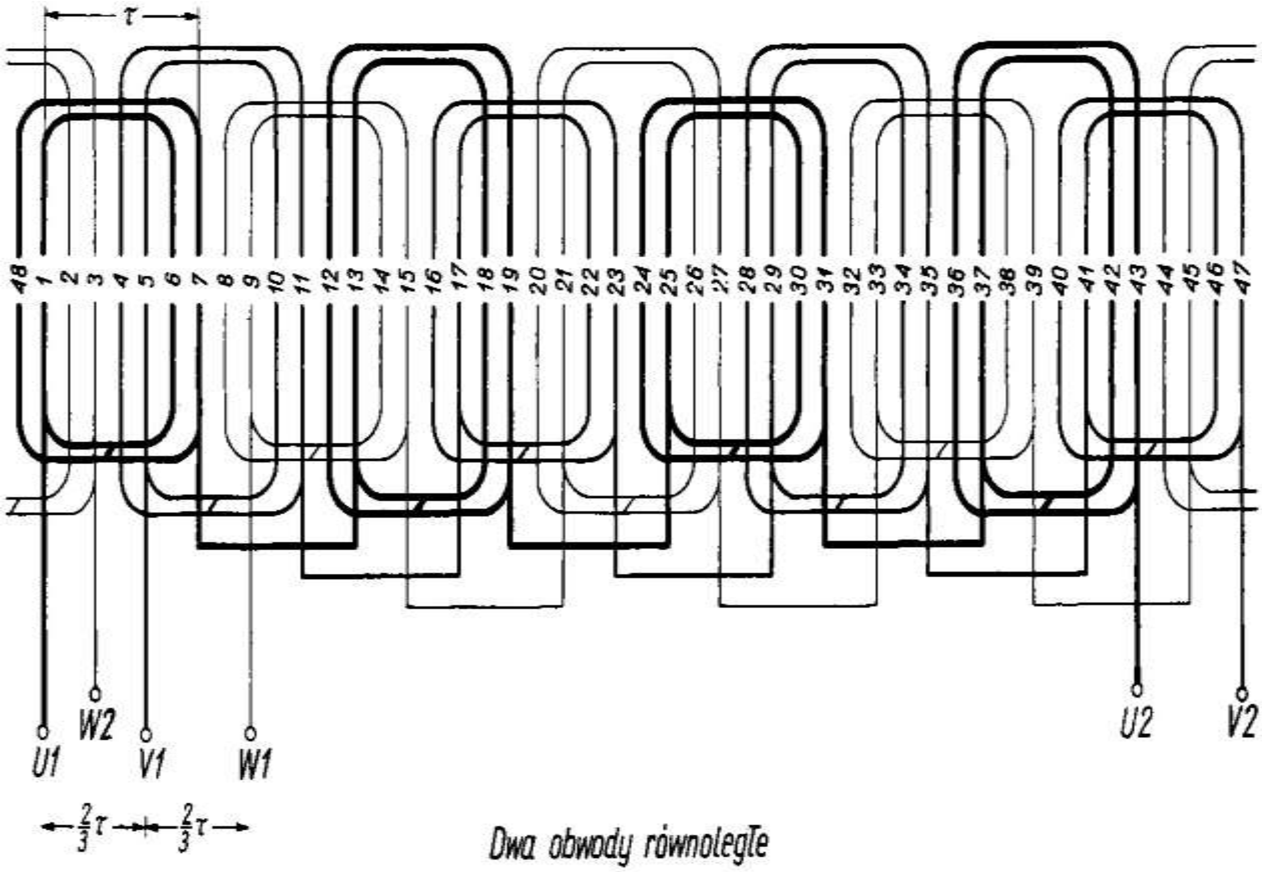
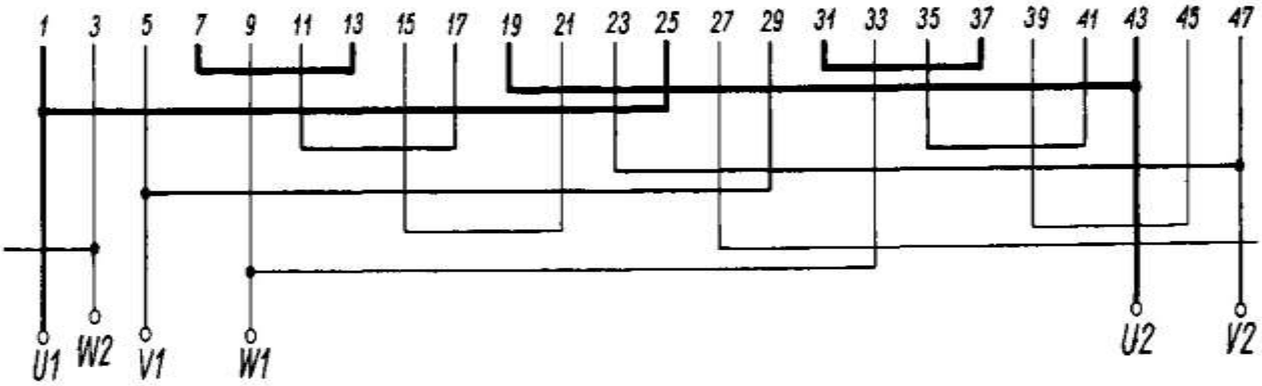


Figure. 19. Three-Tier Winding
Slots = 48; Poles = 4; y = 9, 11; q = 4



Dwa obwody równoległe



Cztery obwody równoległe

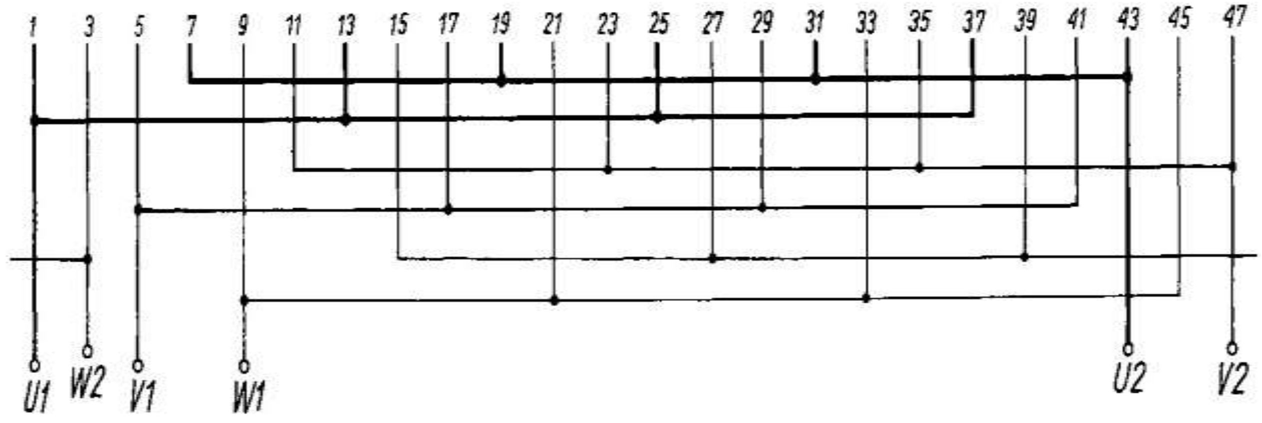


Figure. 20. Two-Tier Winding
Slots = 48; Poles = 8; y = 5, 7; q = 2

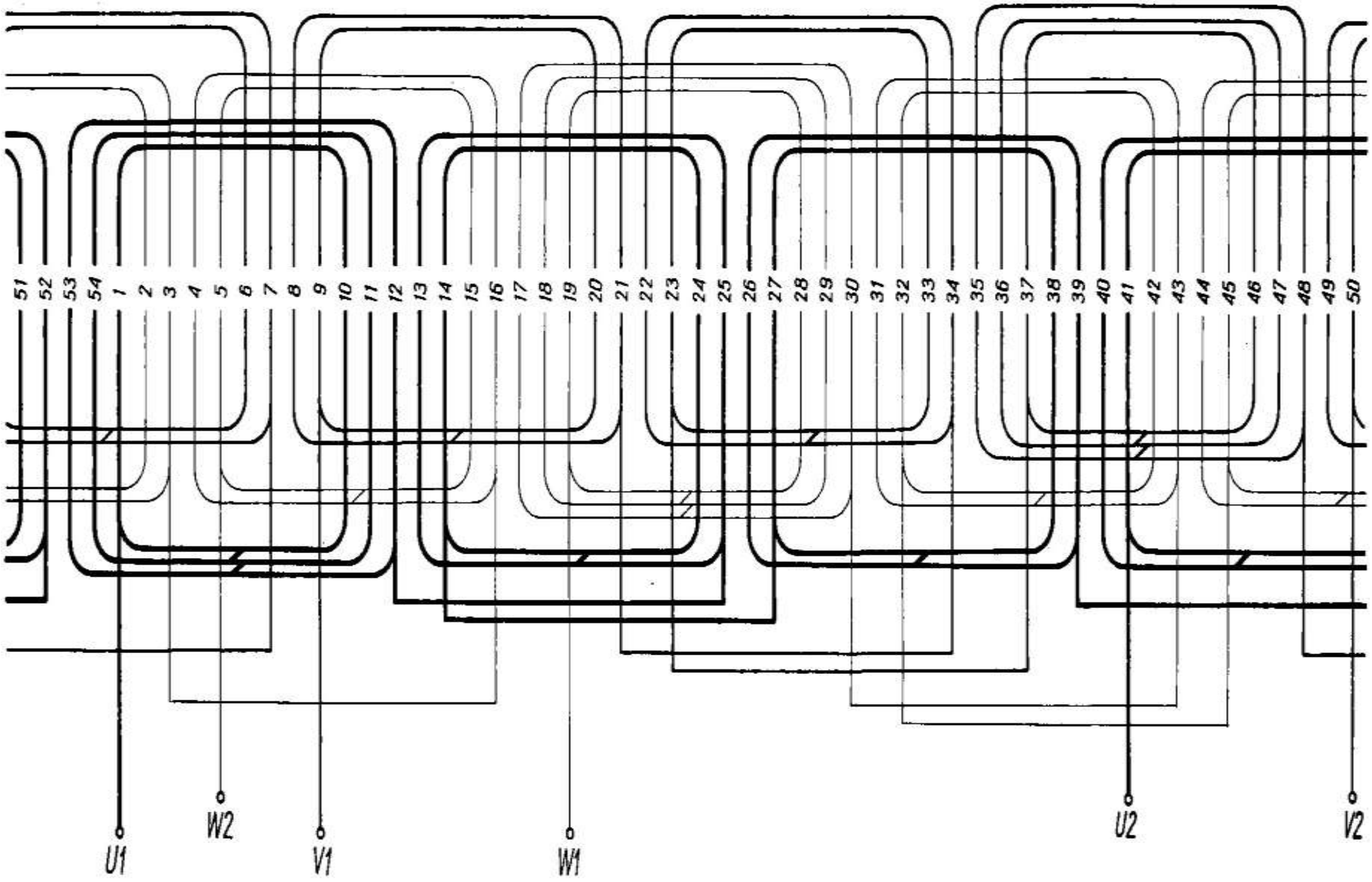


Figure. 21. Three-Tier Winding with odd grouping
Slots=54; Poles = 4; y = 9, 10, 11, 12, 13; q = 4 $^1/_2$

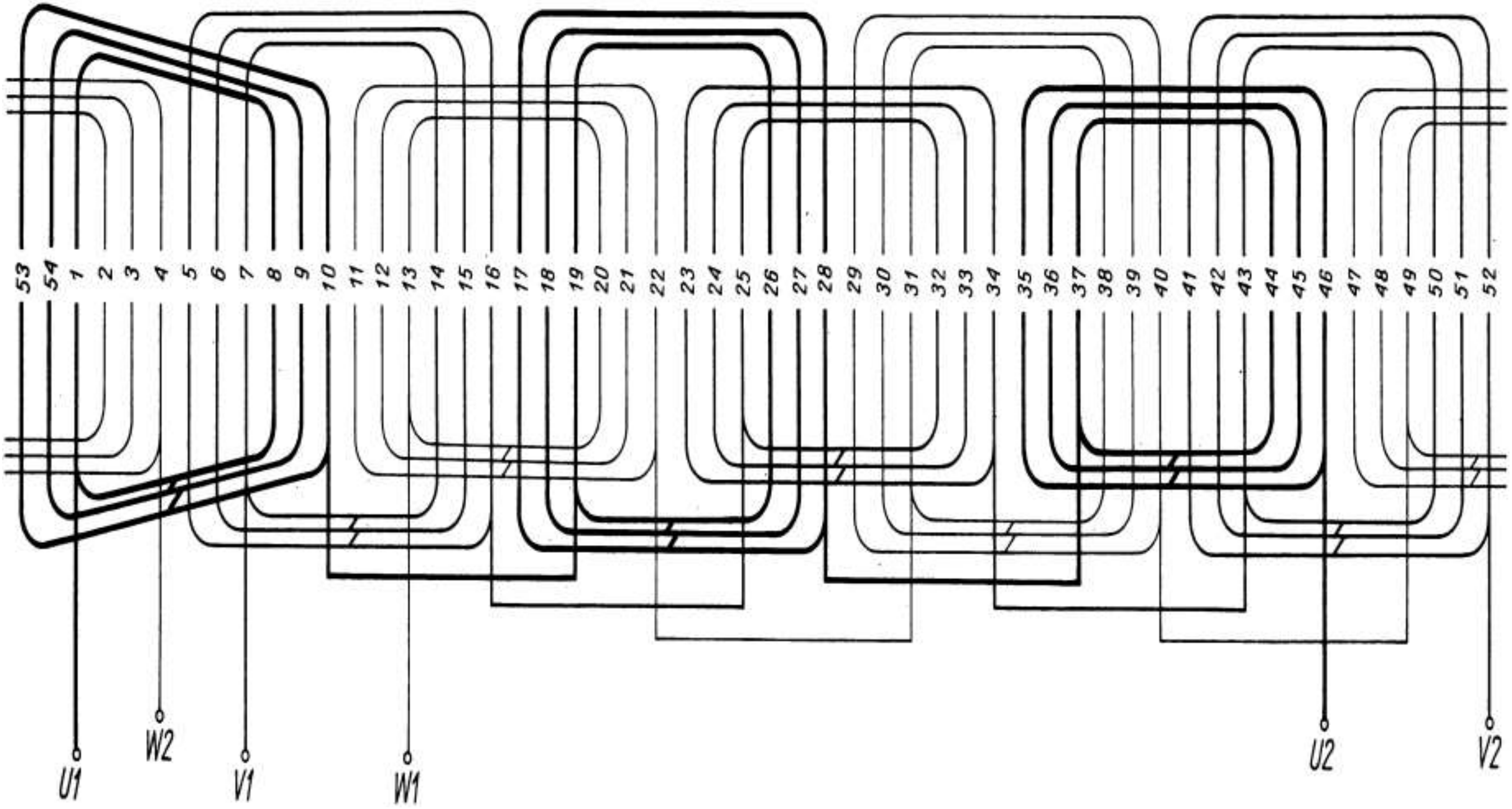
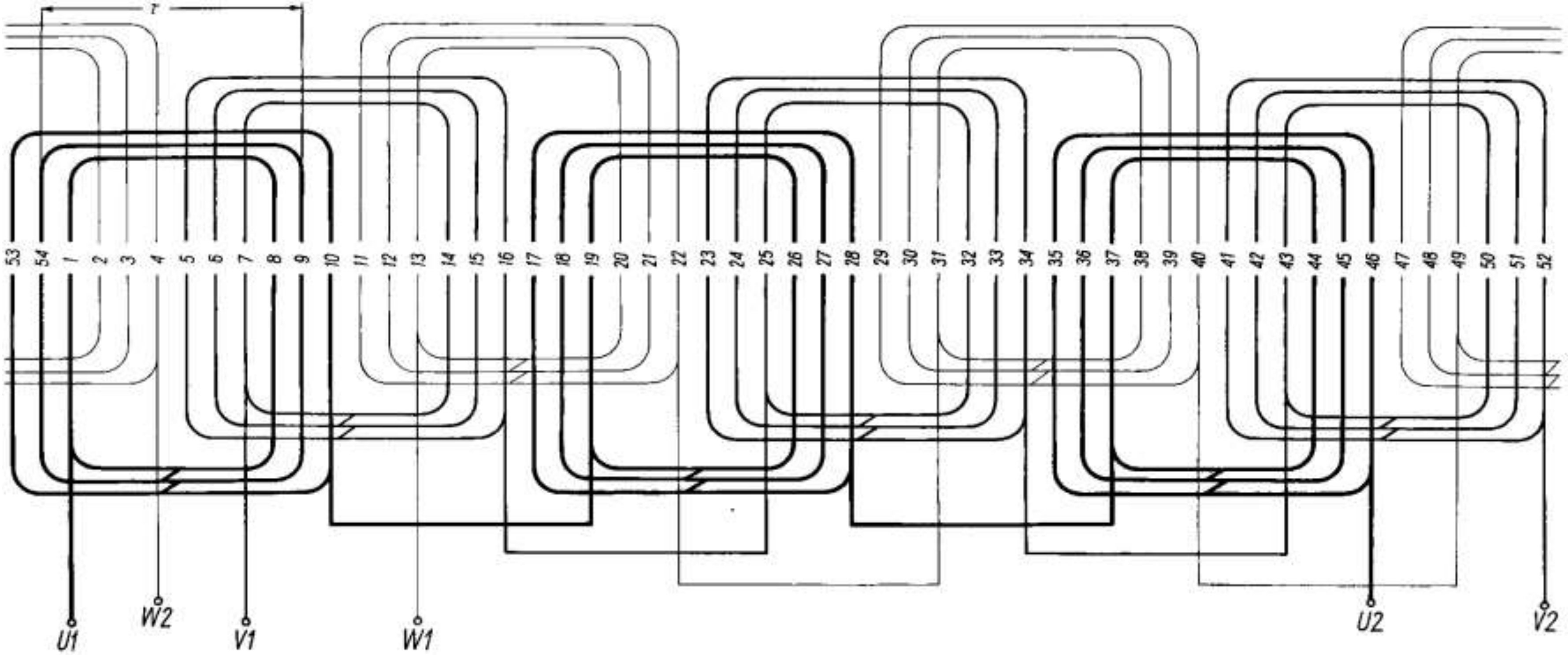


Figure. 22. Two-Tier Winding with crank group
Slots = 54; Poles = 6; y = 7, 9, 11; q = 3



Trzy obwody równoległe

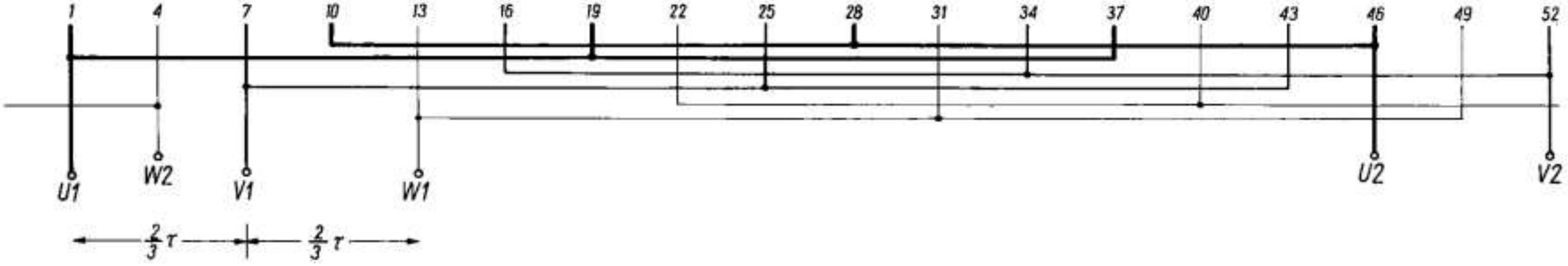


Figure. 23. Three-Tier Winding
Slots = 54; Poles = 6; y = 7, 9, 11; q = 3

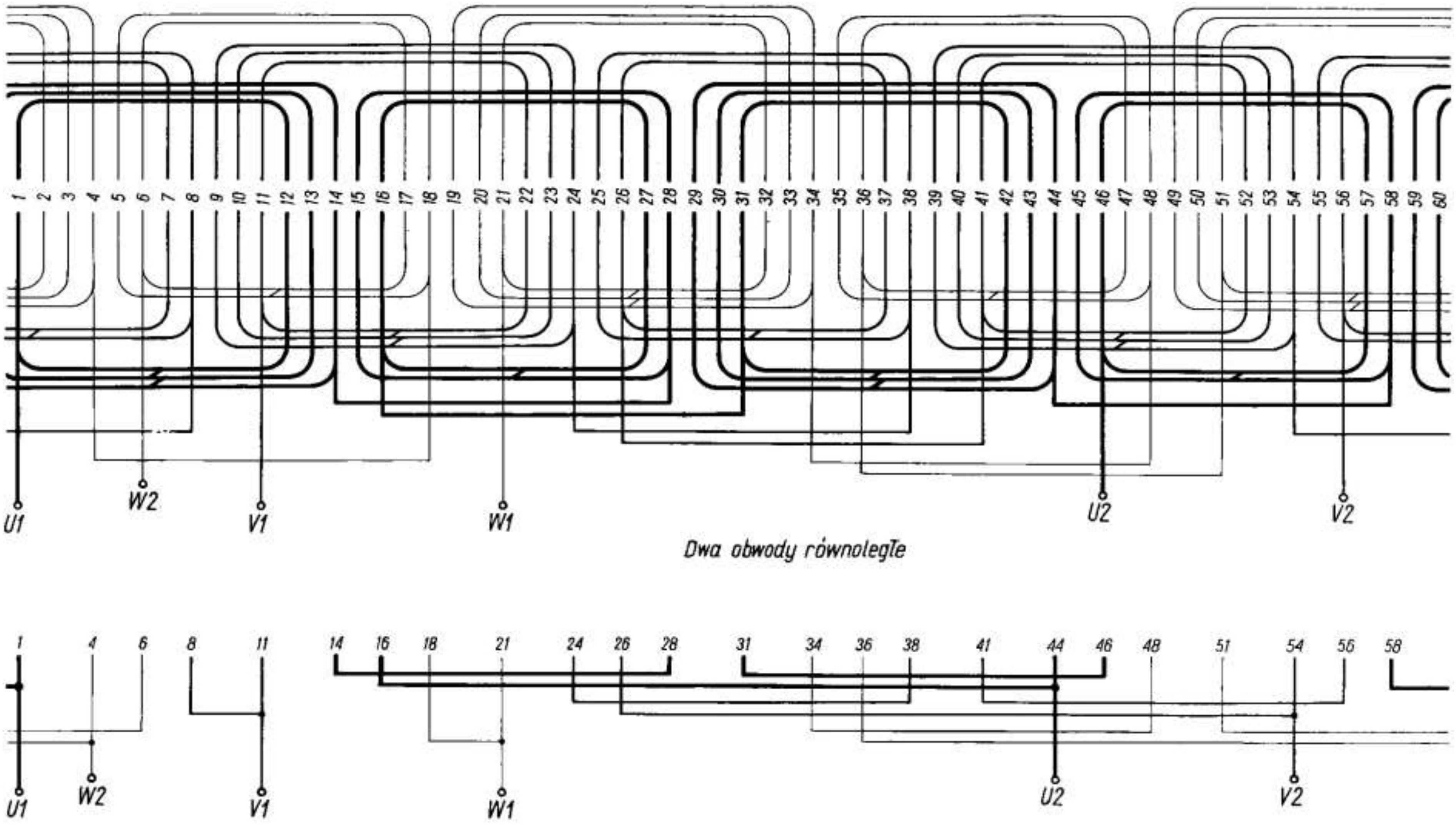


Figure. 24. Three-Tier Winding with odd grouping
Slots = 60; Poles = 4; y= 11, 13, 15; q = 5

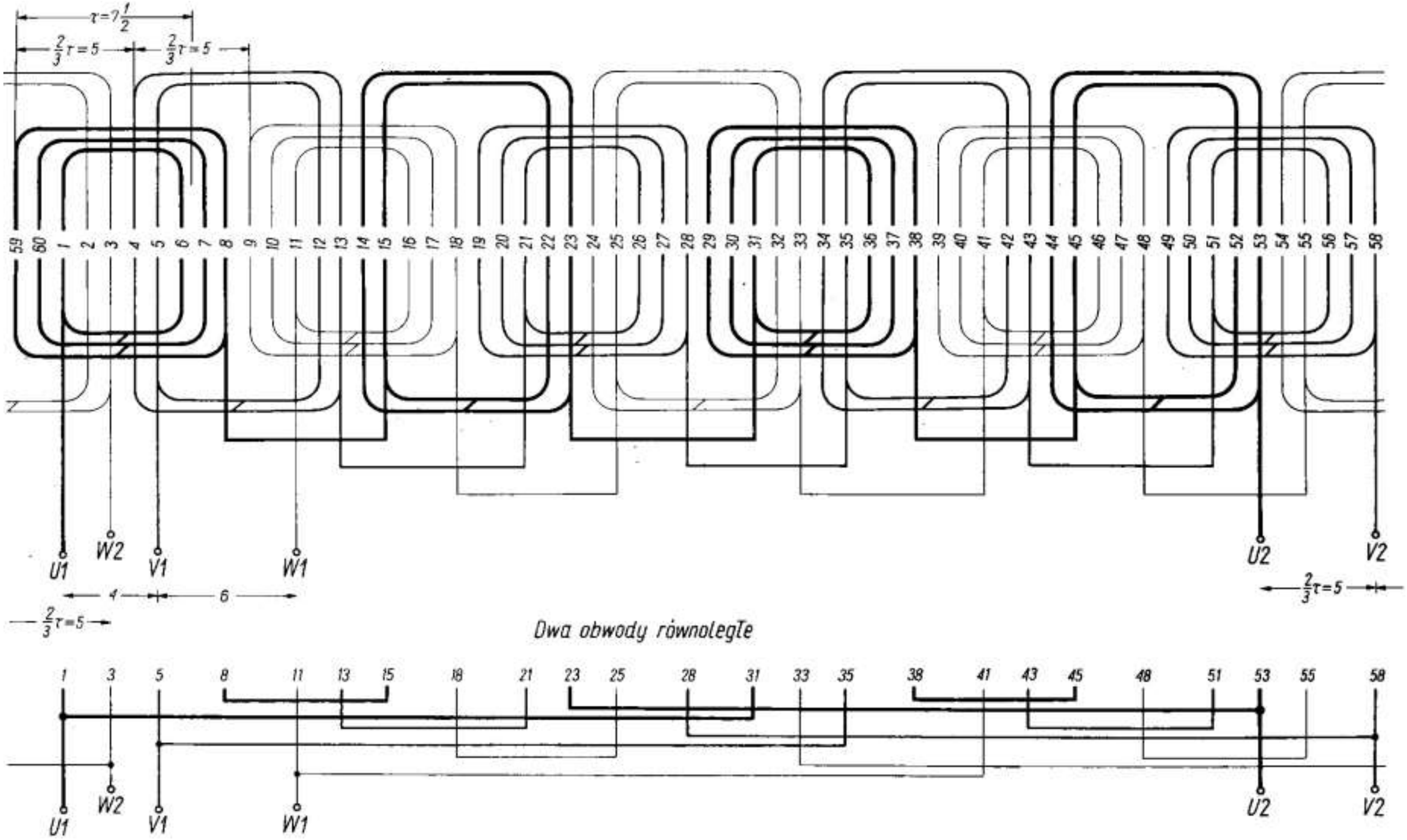
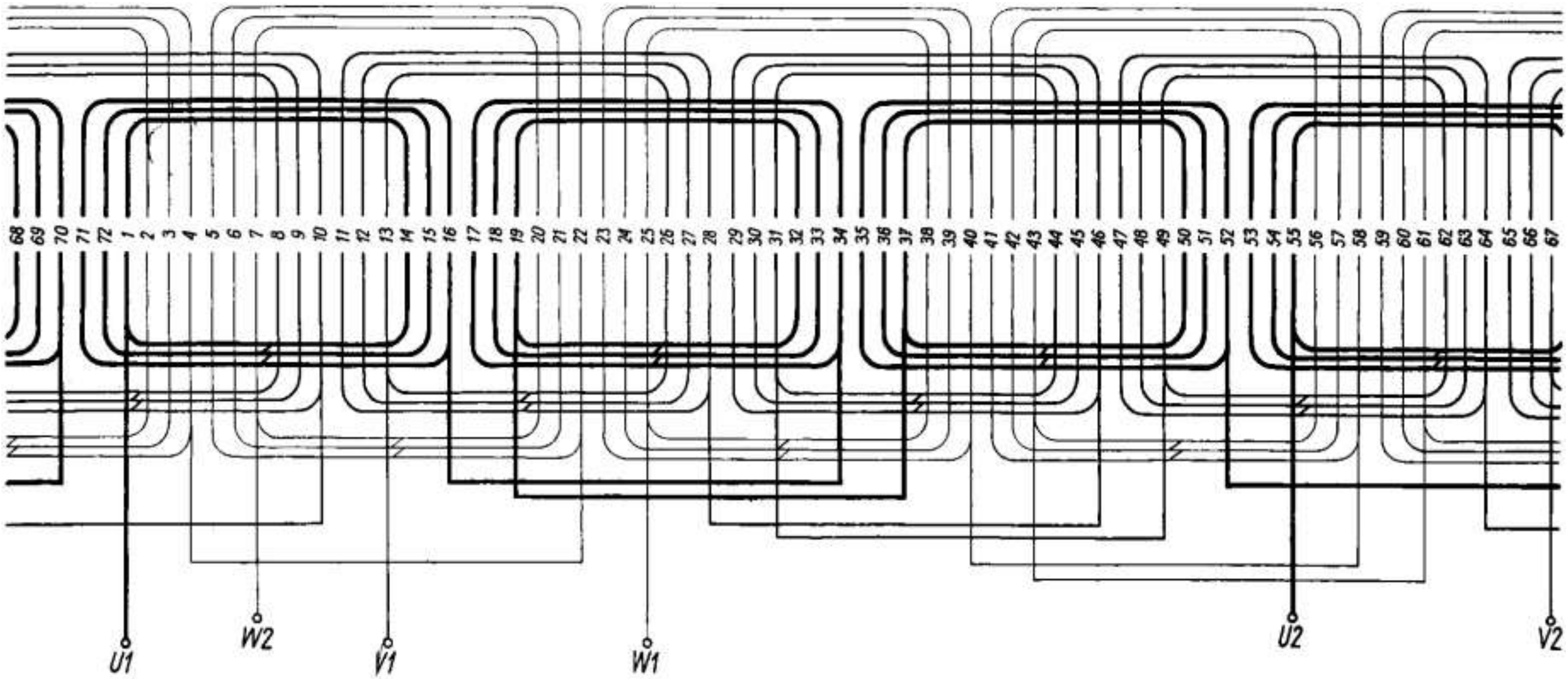


Figure. 25. Two-Tier Winding with odd Groups
Slots = 60; Poles = 8; y = 5, 7, 9; q = 2 $^1/_2$



Dwa obwody równolegle

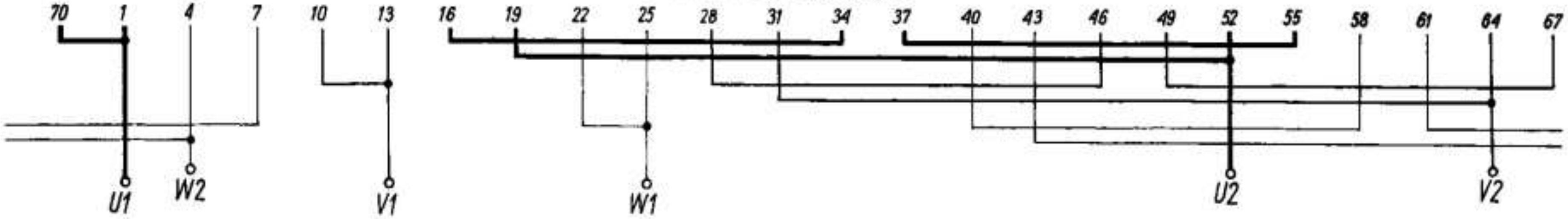


Figure. 26. Three-Tier Winding
Slots = 72; Poles = 4; y = 13, 15, 17; q = 6

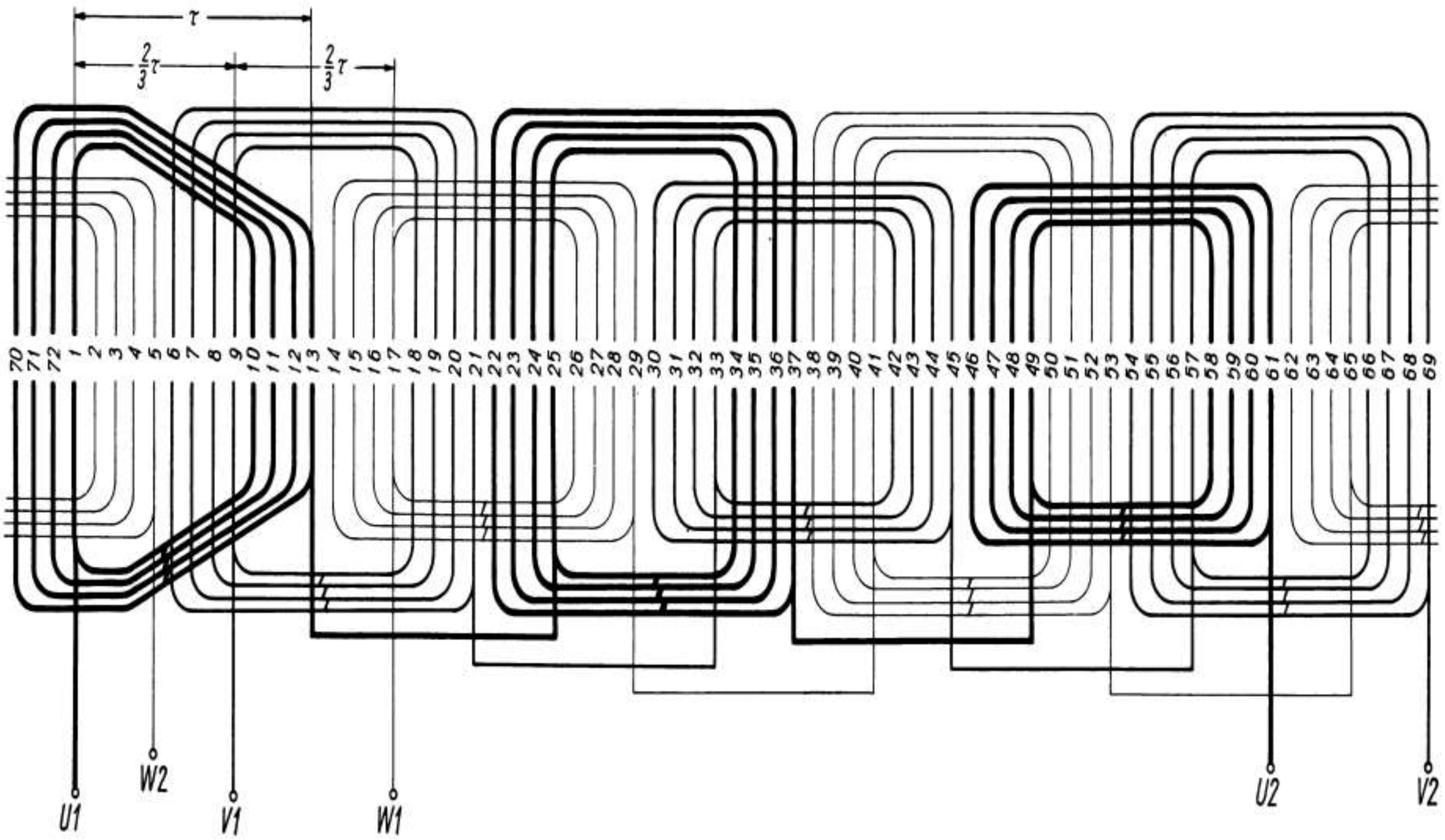


Figure. 27. Two-Tier Winding with Crank group
Slots = 72; Poles = 6; y = 9, 11, 13, 15; q = 4

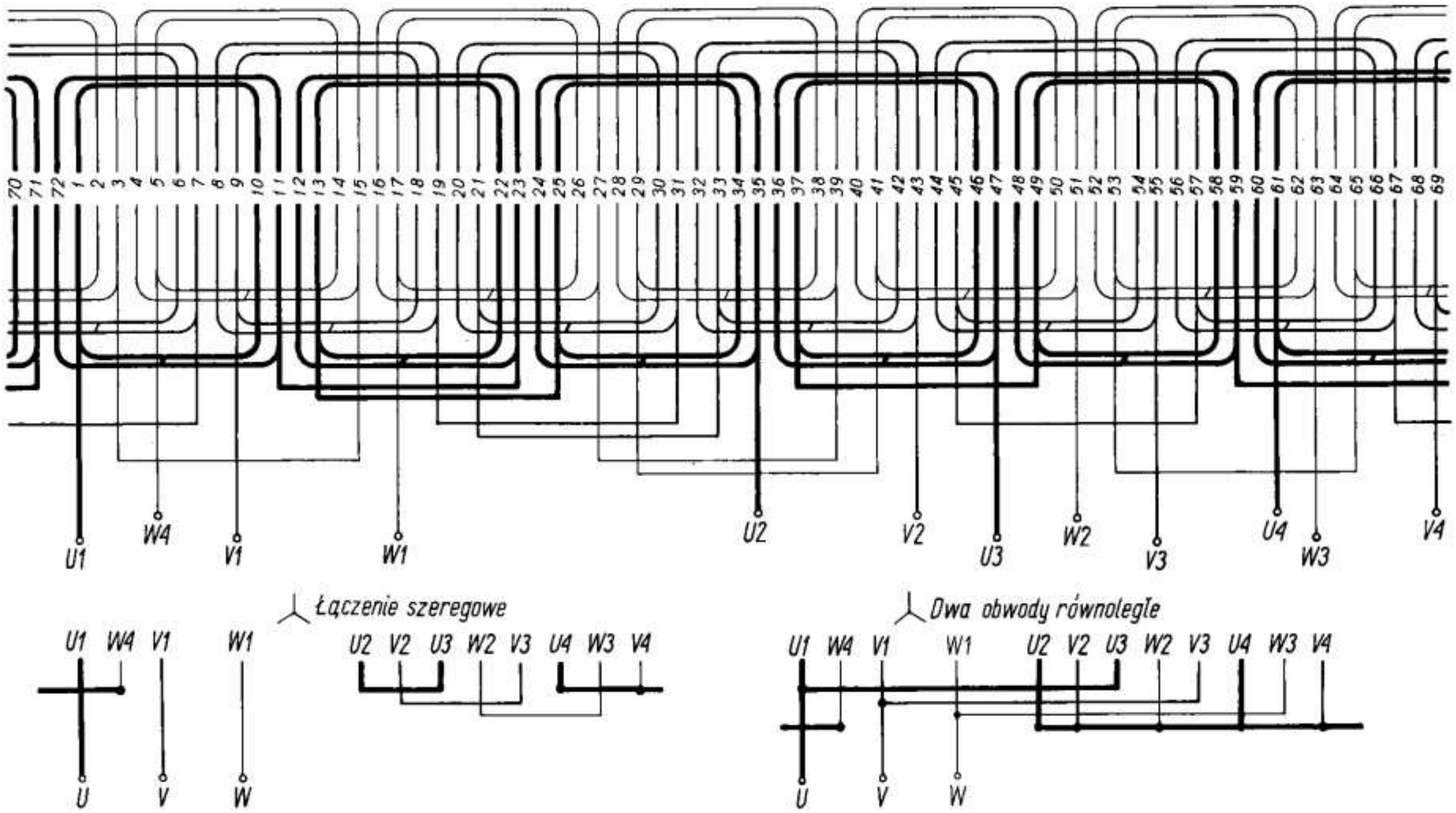
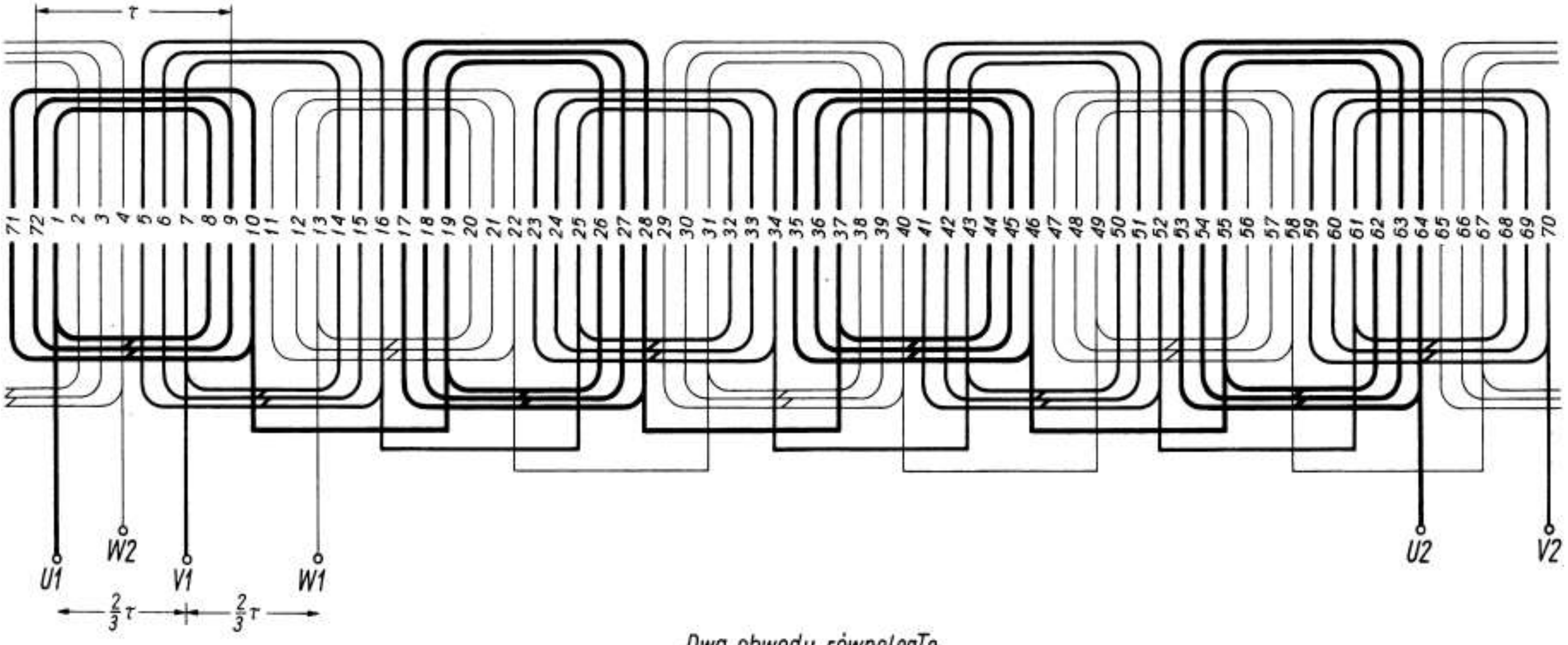


Figure. 28. Three-Tier Winding
Slots = 72; Poles = 6; y = 9, 11; q = 4



Dwa obwody równoległe

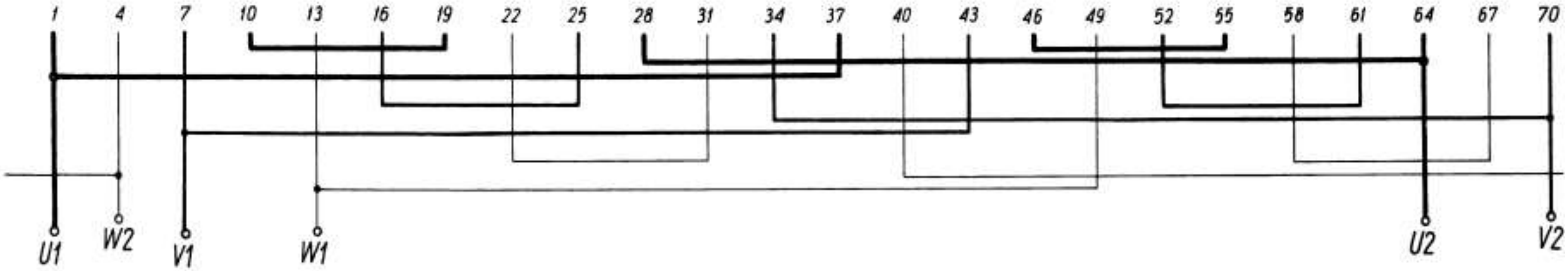


Figure. 29. Two-Tier Winding

Slots = 72; Poles = 8; y = 7, 9, 11; q = 3

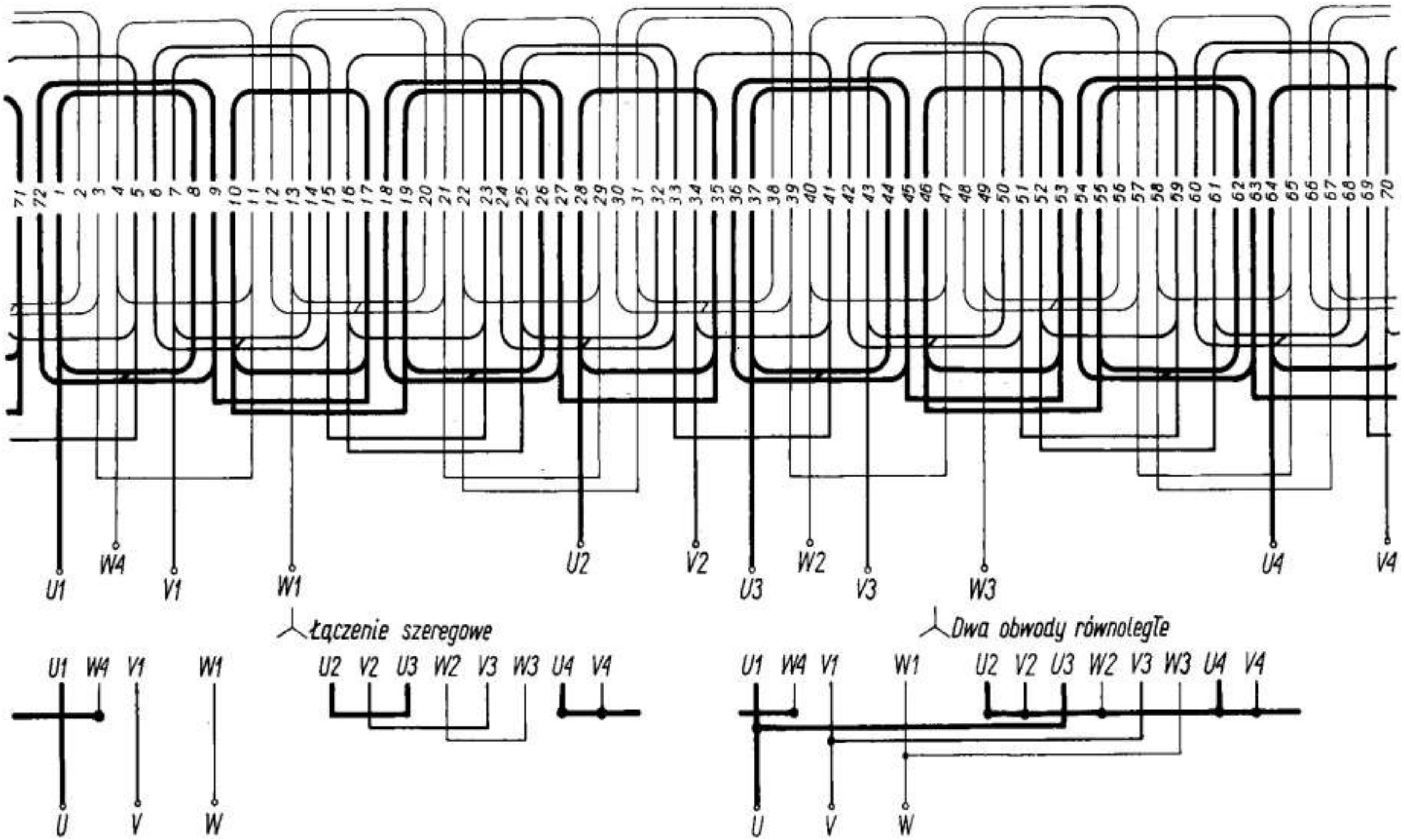


Figure. 30. Three-Tier Winding with odd groupings
Slots = 72; Poles = 8; y = 7, 9; q = 3

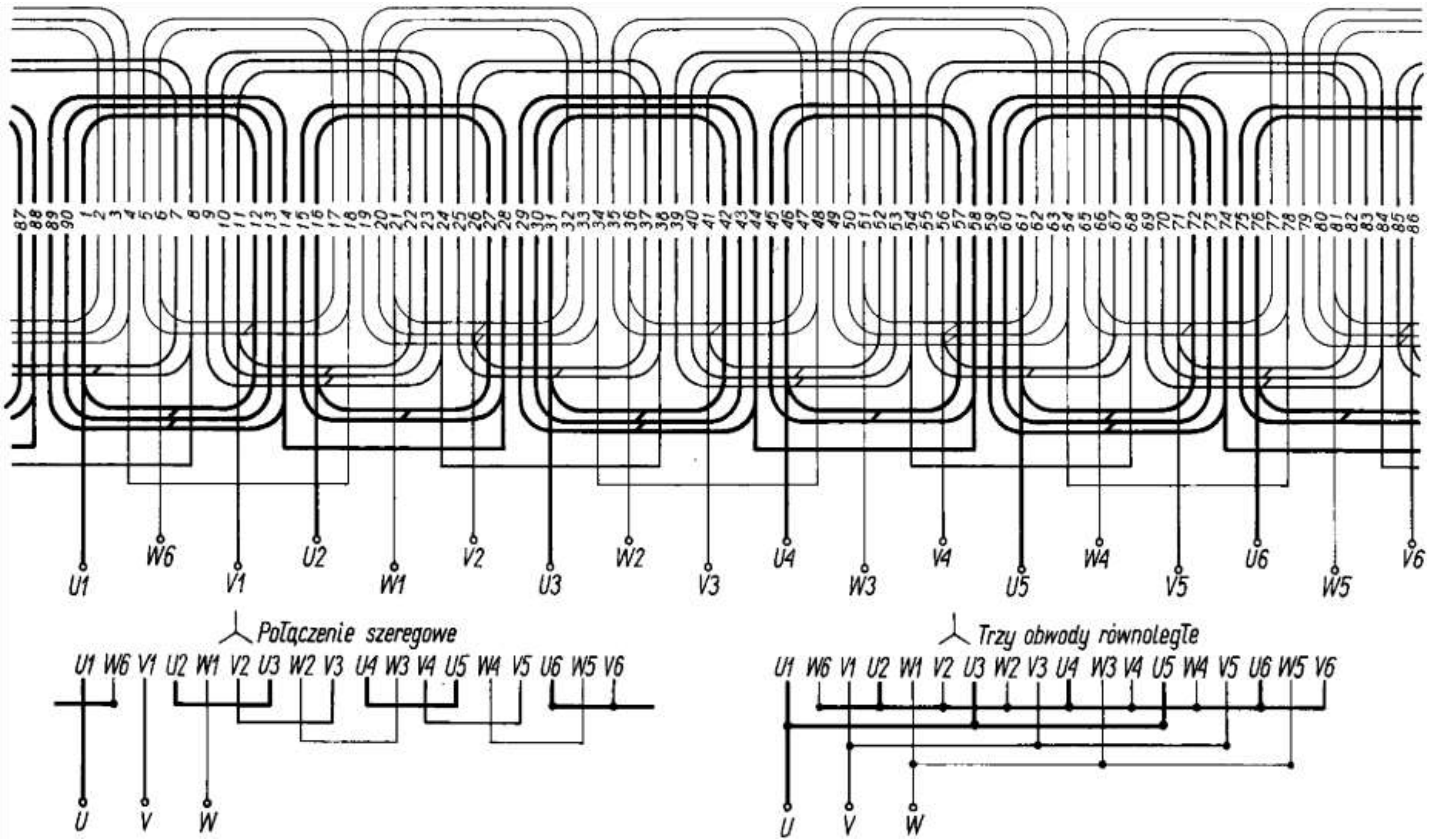


Figure. 31. Three-Tier Winding with odd groupings
Slots = 90; Poles = 6; y = 11, 13, 15; q = 5

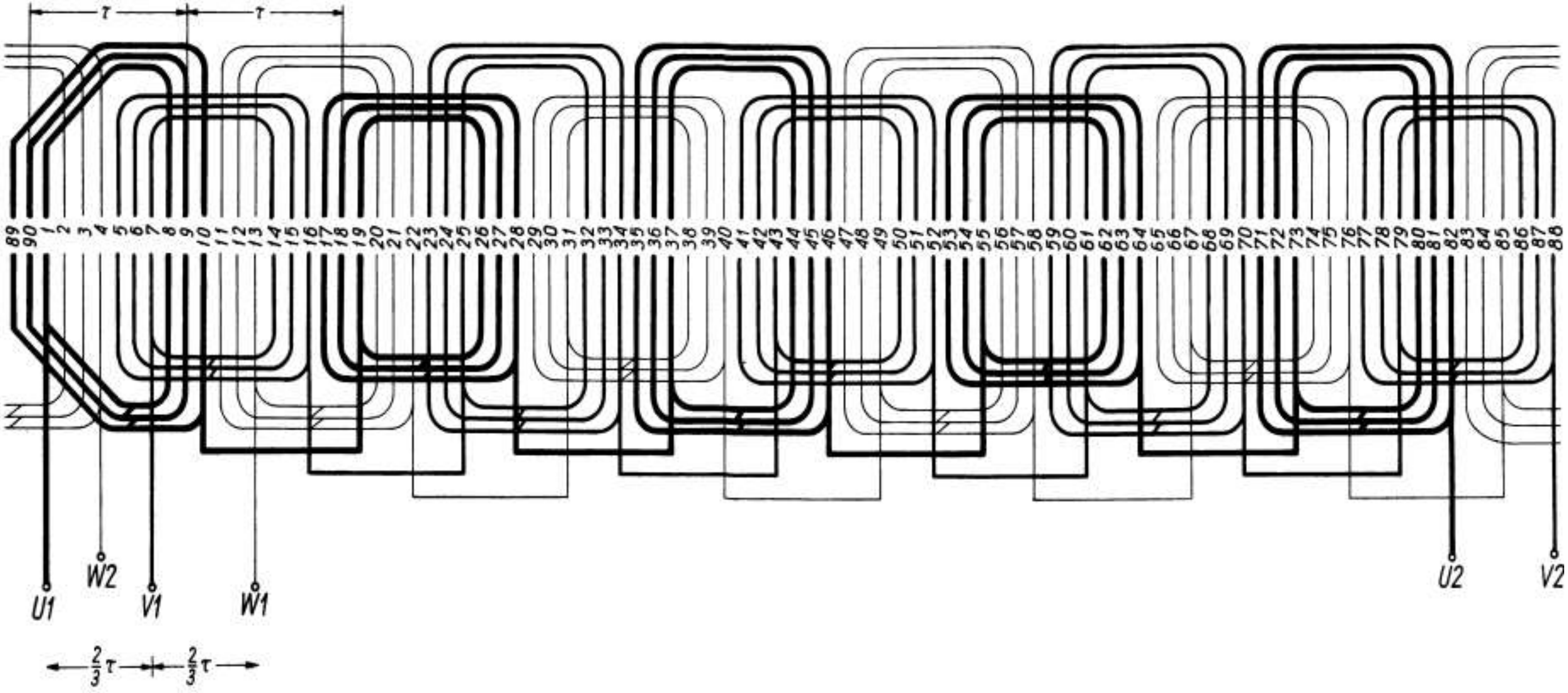


Figure. 32. Two-Tier Winding with crank group
Slots = 90; Poles = 10; y = 7, 9, 11; q = 3

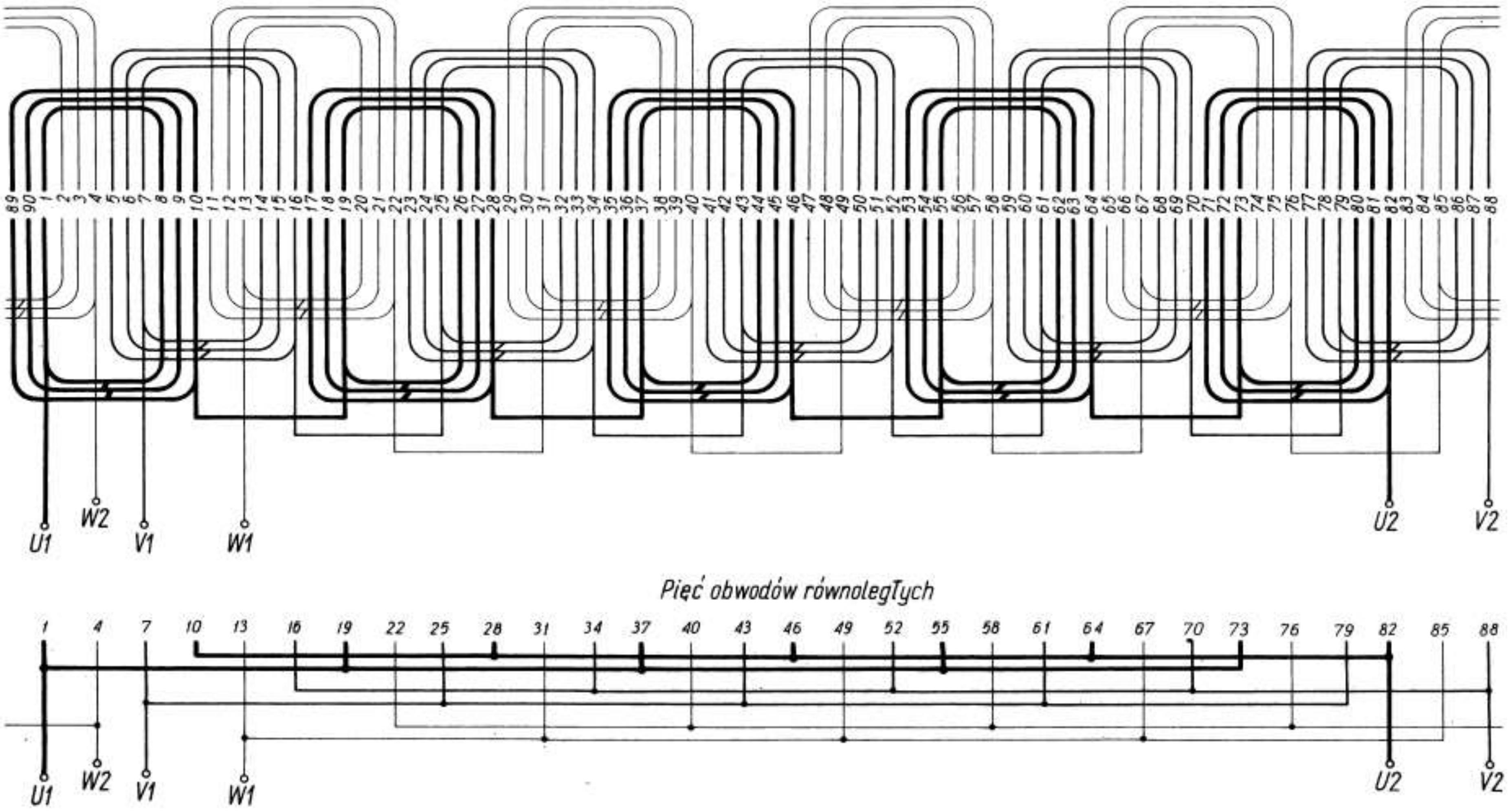


Figure. 32a. Three-Tier Winding

Slots = 90; Poles = 10; y = 7, 9, 11; q = 3

2. 1. 2. Concentric / Chain Group Winding

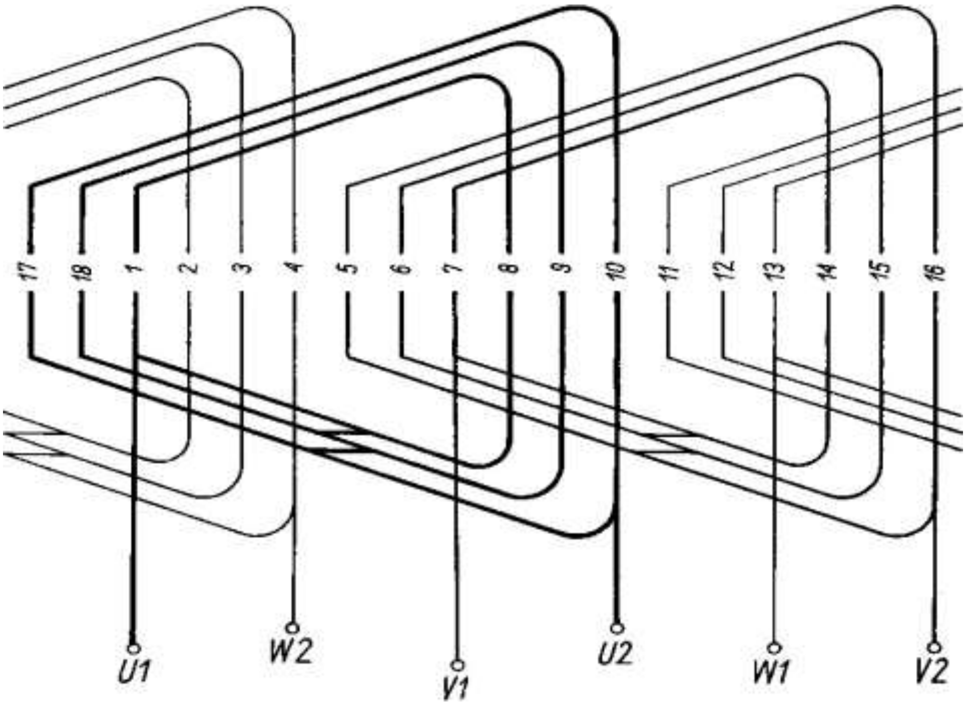


Figure. 33. Concentric Chain Group Winding
Slots = 18; Poles = 2; y = 7, 9, 11; q = 3

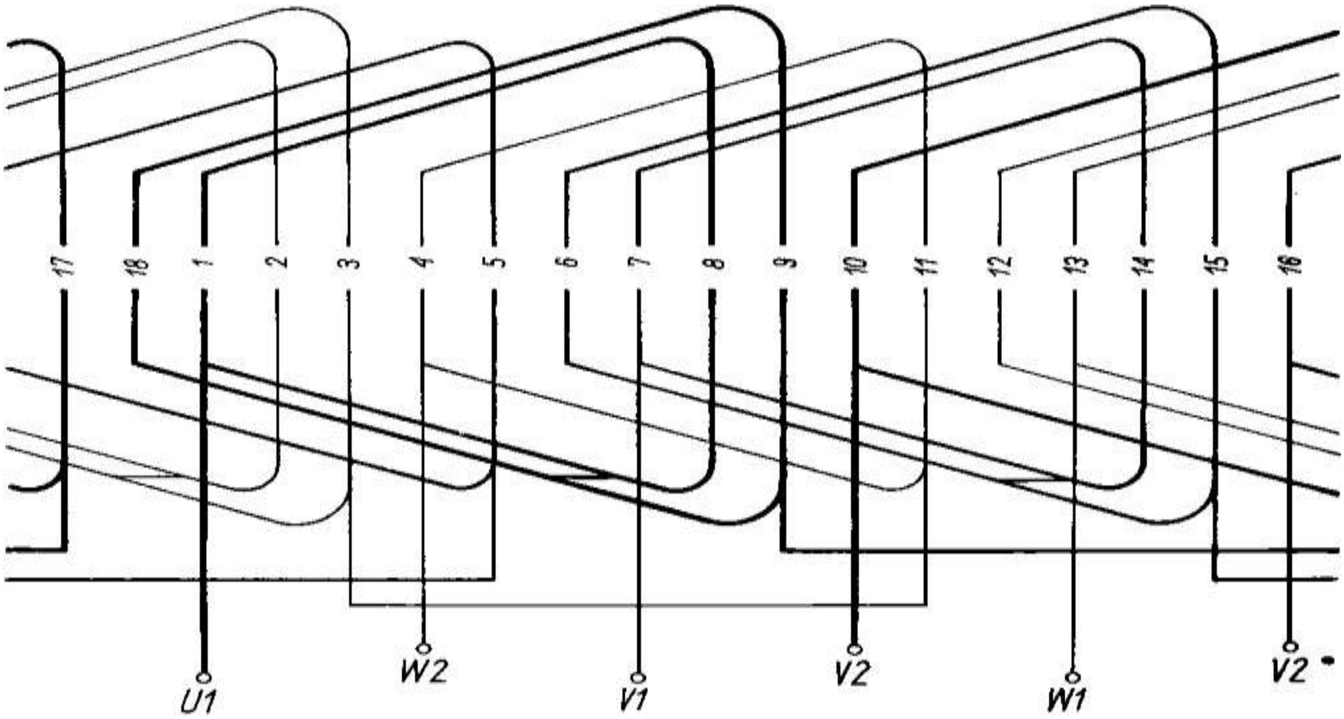


Figure. 33a. Concentric Chain Group Winding with odd groups
Slots = 18; Poles = 2; y = 7, 9; q = 3

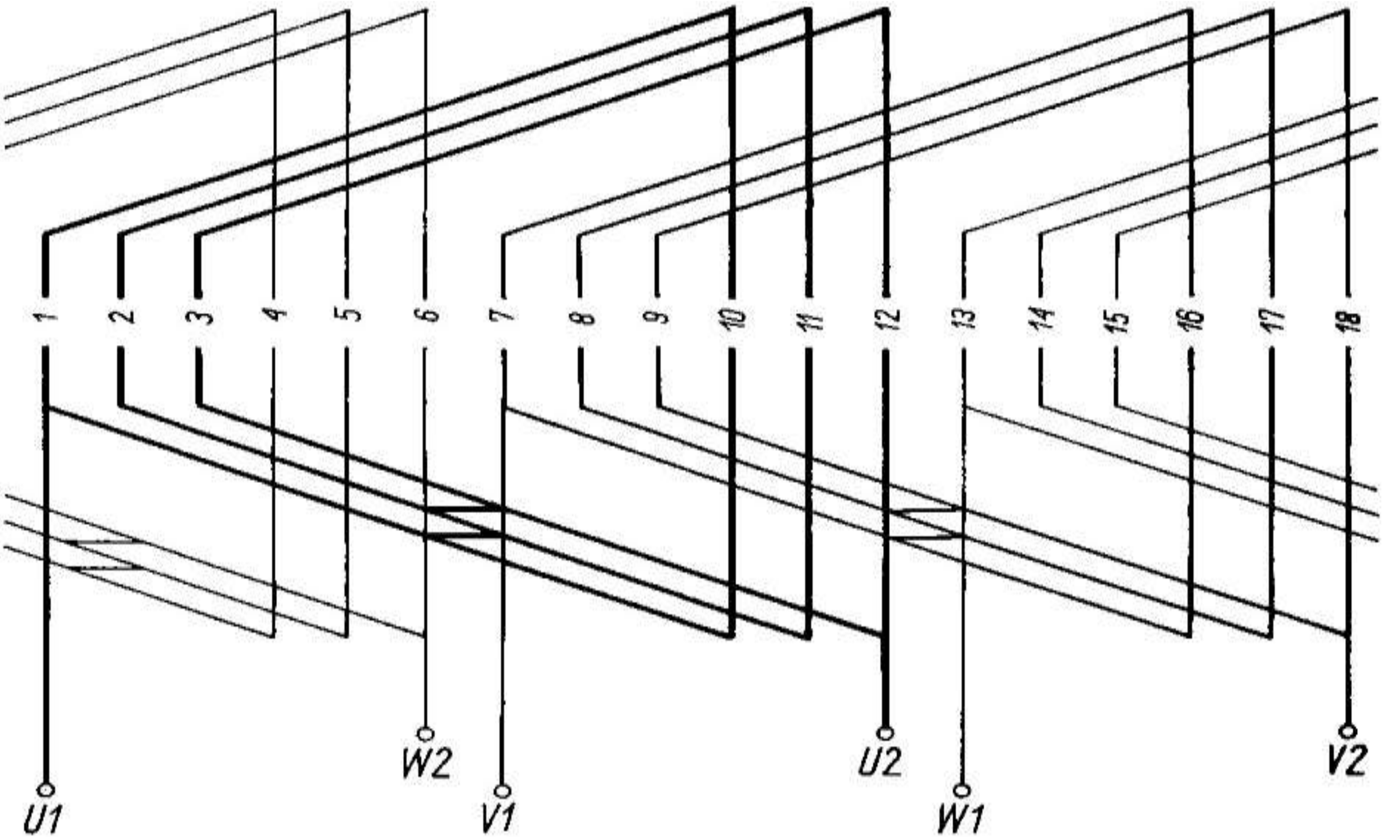


Figure. 33b. Chain Group Winding
Slots = 18; Poles = 2; y = 9; q = 3

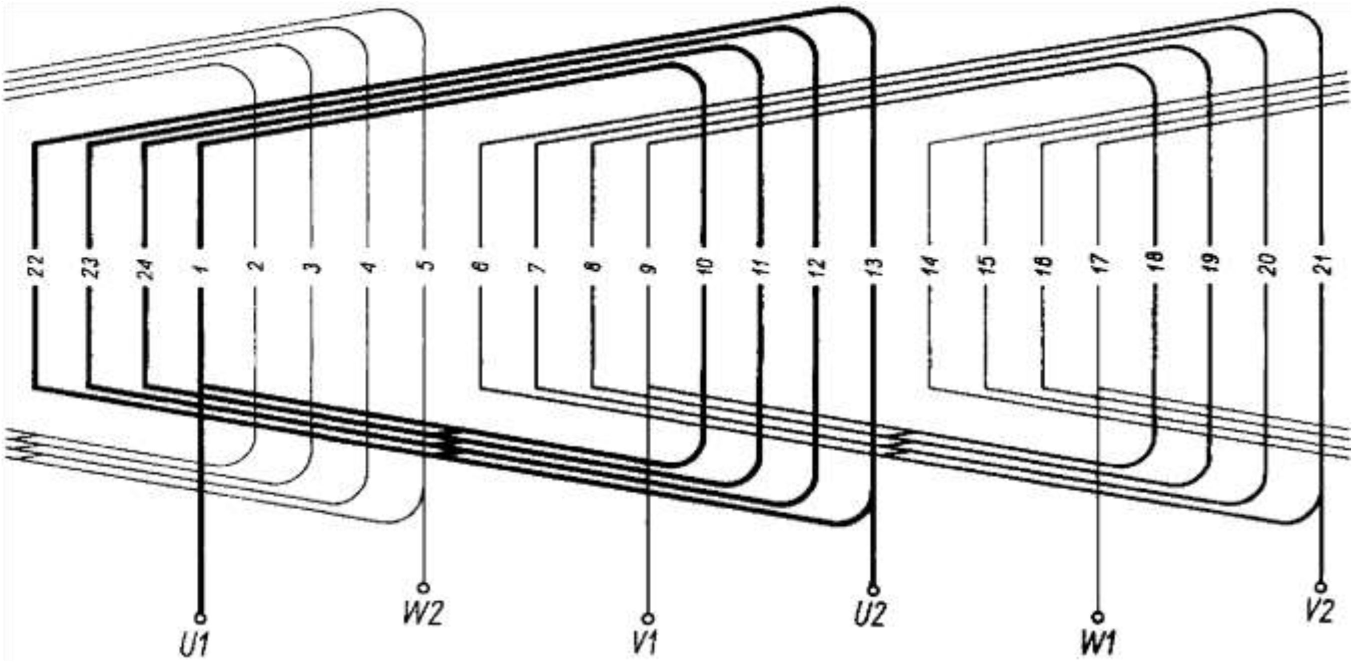


Figure. 34. Concentric Chain Group Winding
Slots = 24; Poles = 2; y = 9, 11, 13, 15; q = 4

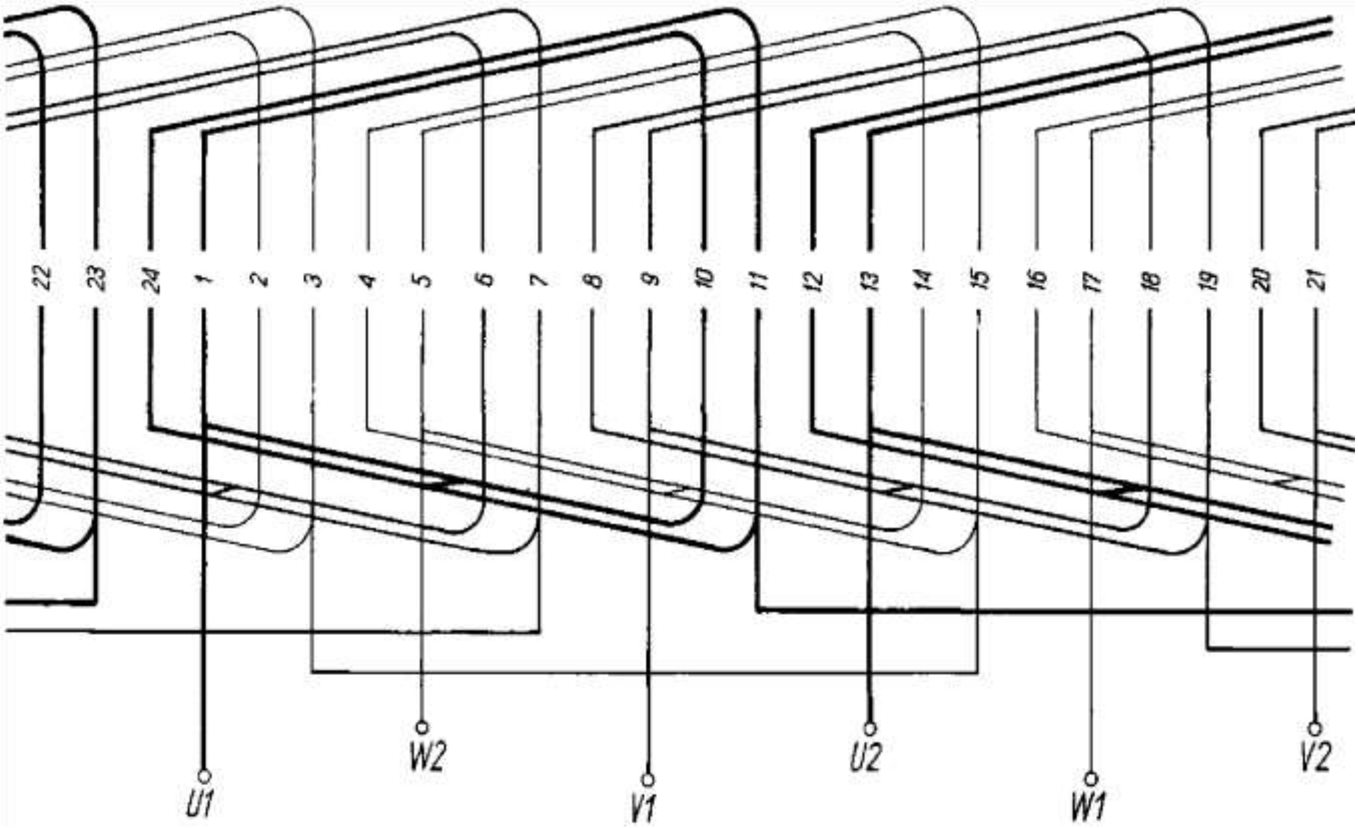


Figure. 34a. Concentric Chain Group Winding
Slots = 24; Poles = 2; y = 9, 11; q = 4

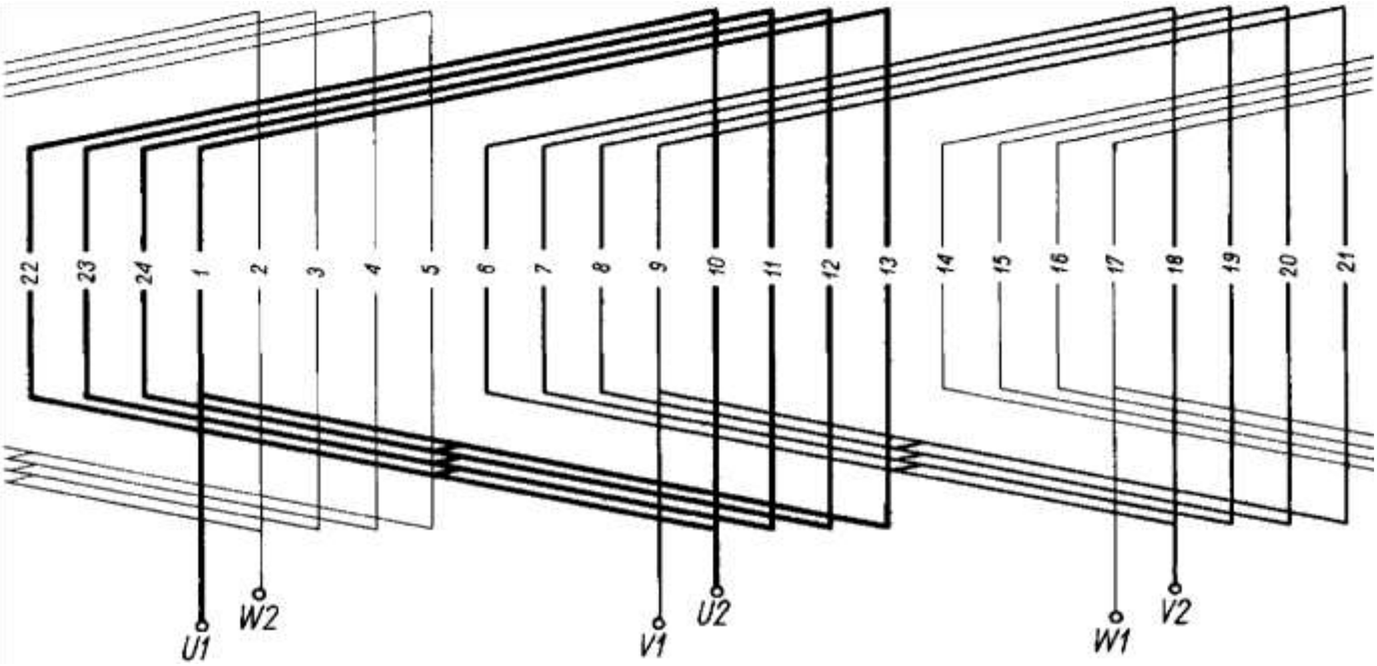
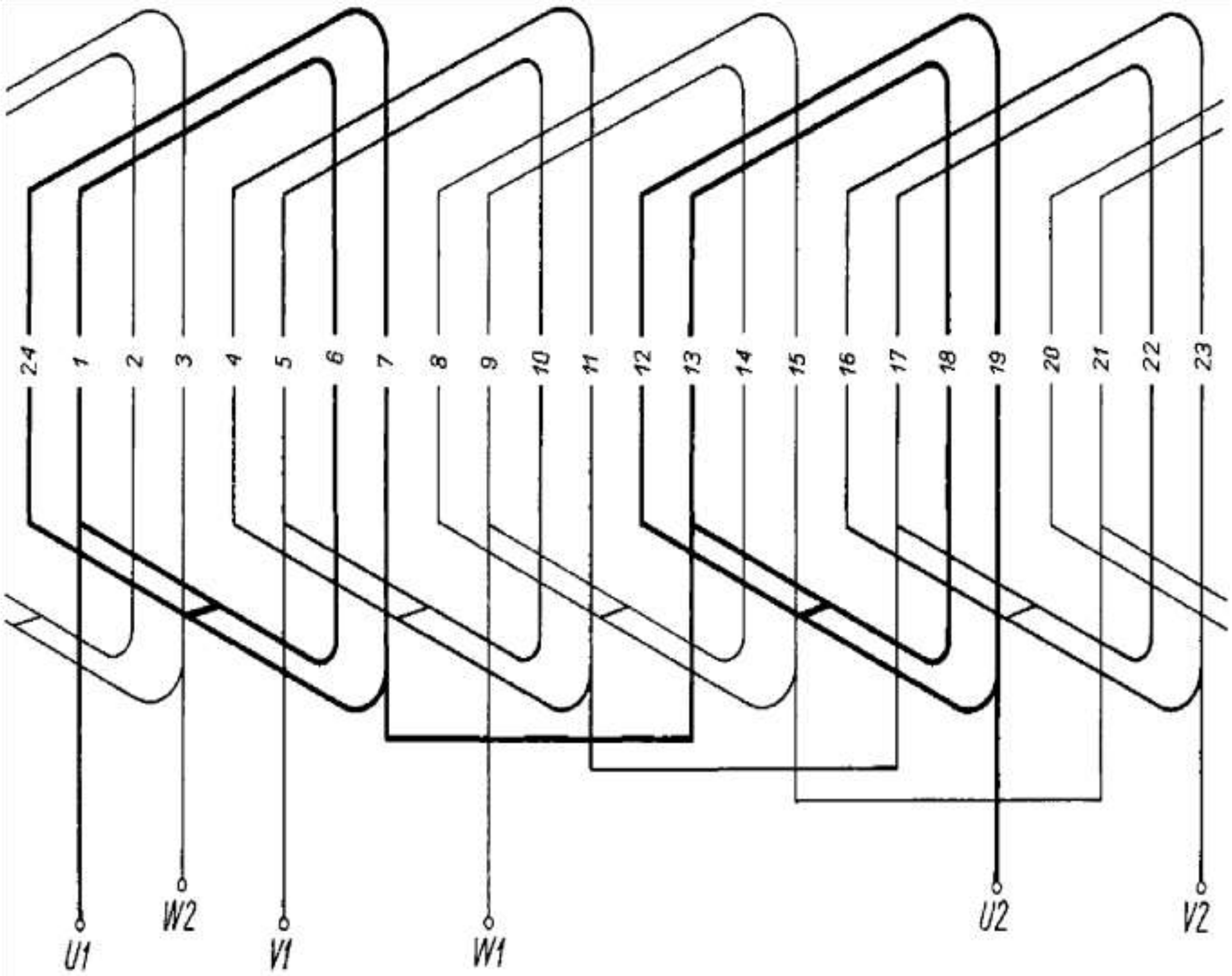


Figure. 35. Chain Group Winding
Slots = 24; Poles = 2; y = 12; q = 4



Dwa obwody równoległe

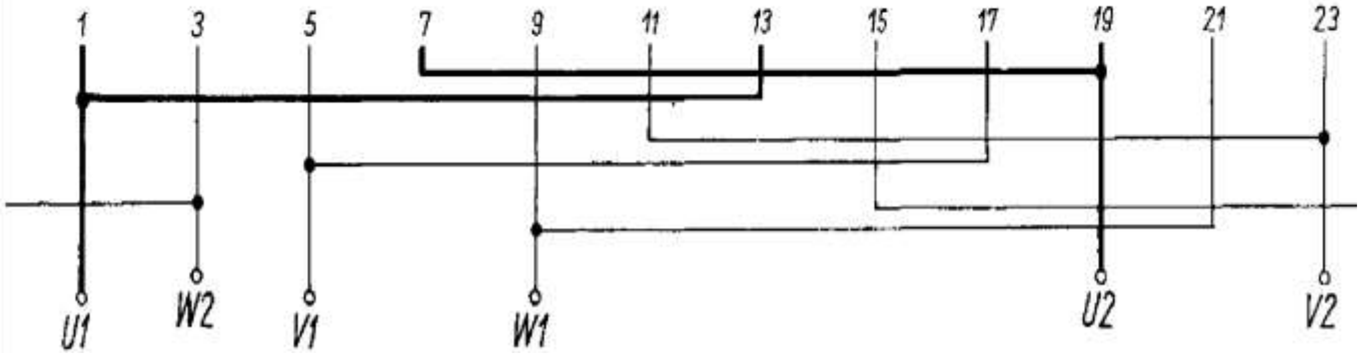
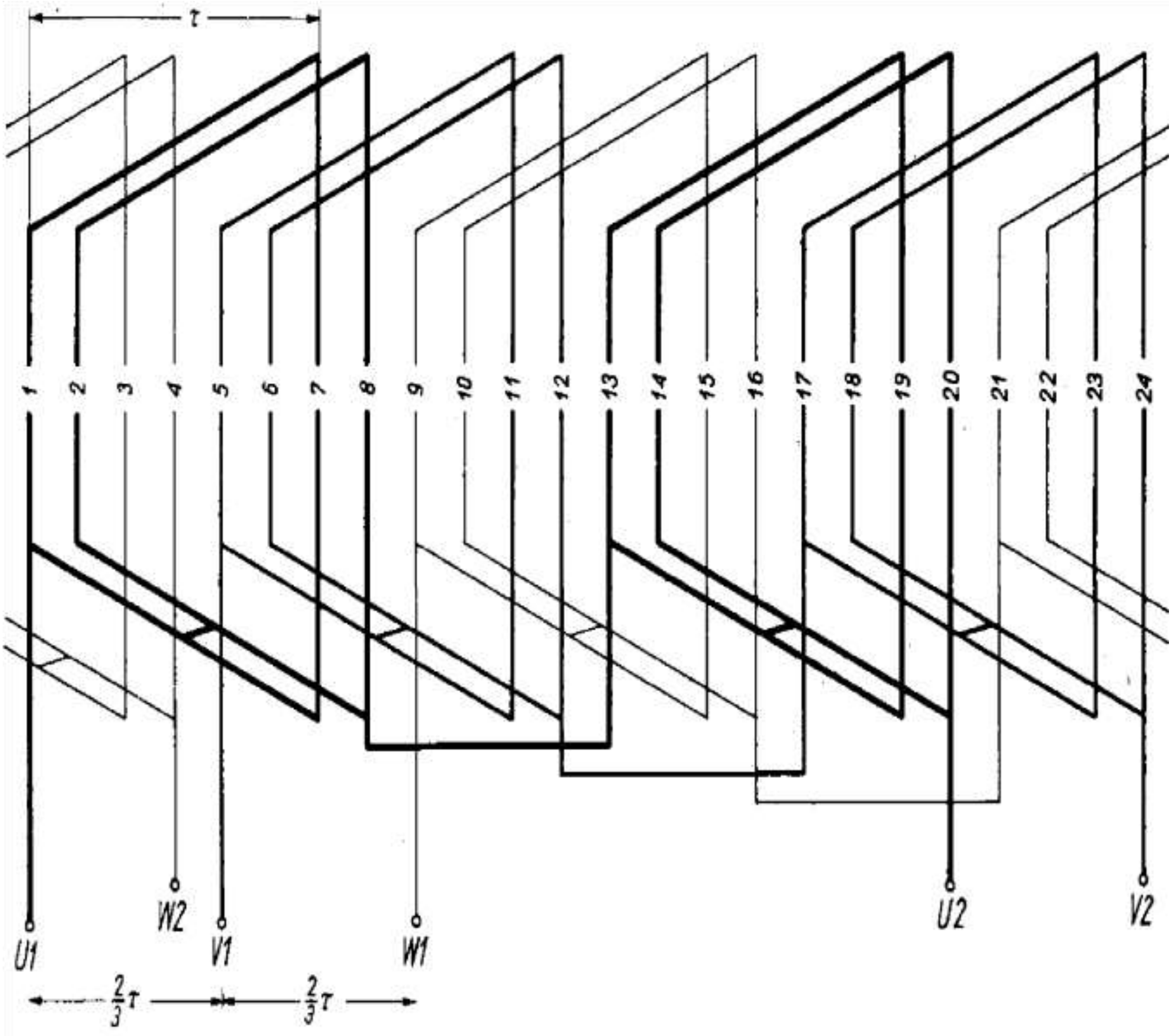


Figure. 36. Concentric Chain Group Winding
Slots = 24; Poles = 4; y = 5, 7; q = 2



Dwa obwody równoległe

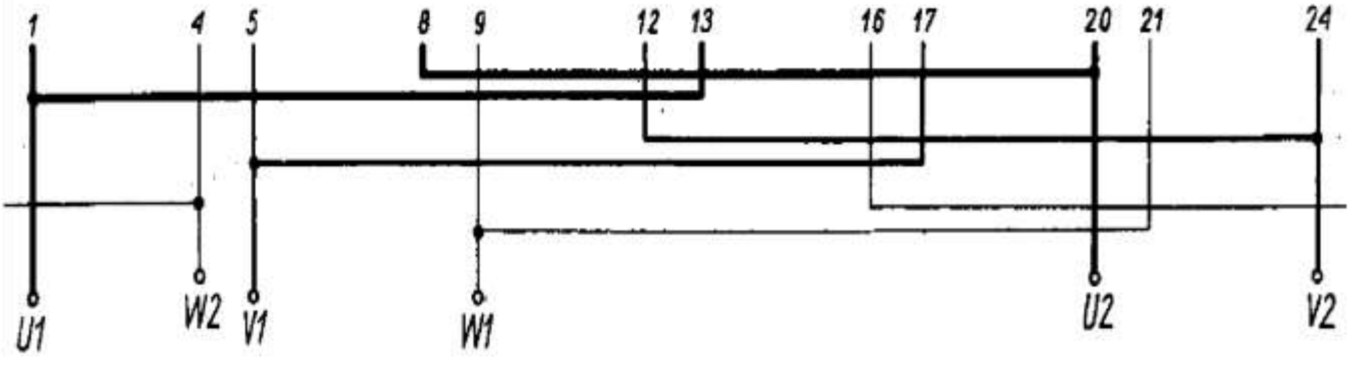


Figure. 37. Chain Group Winding
Slots = 24; Poles = 4; y = 6; q = 2

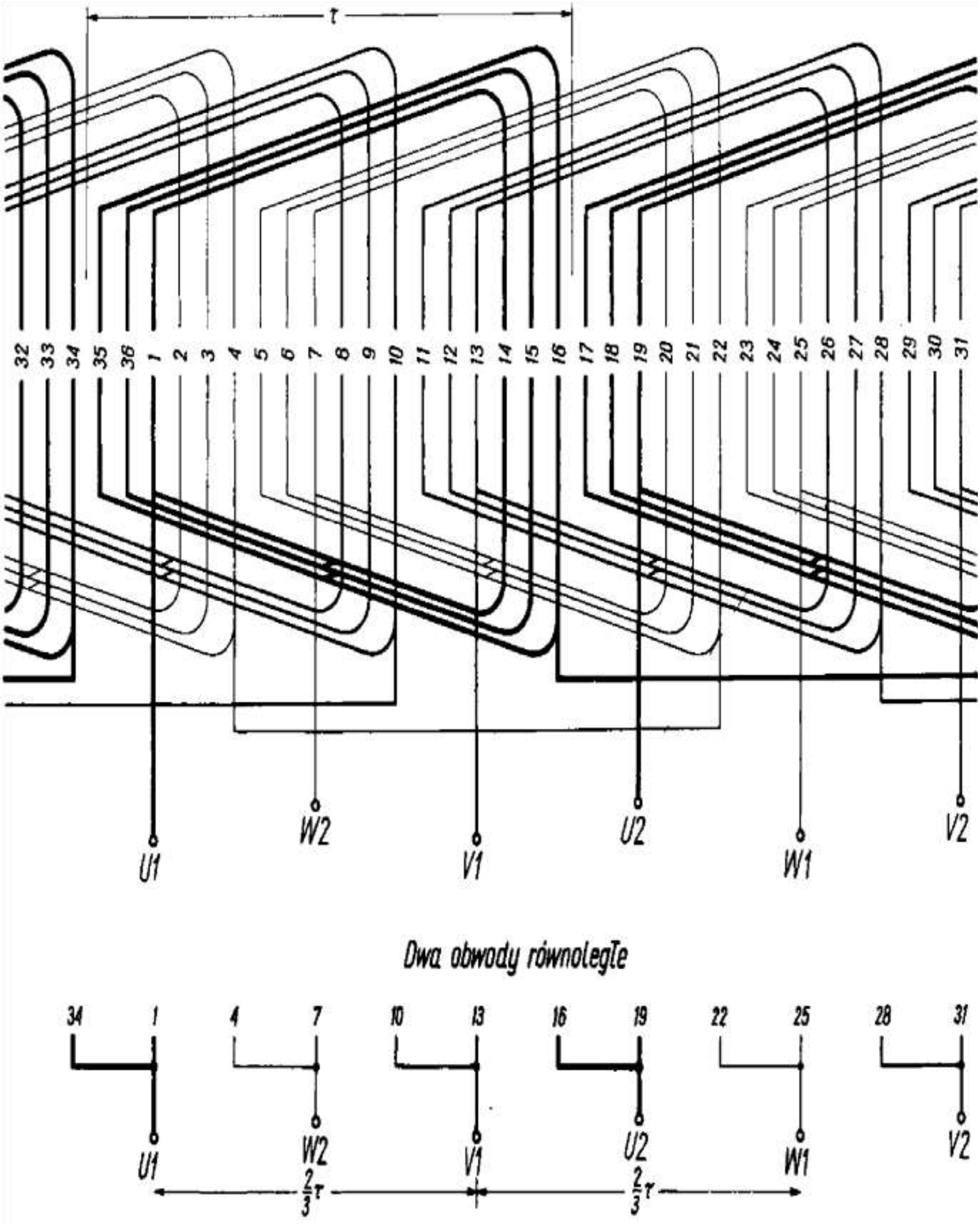
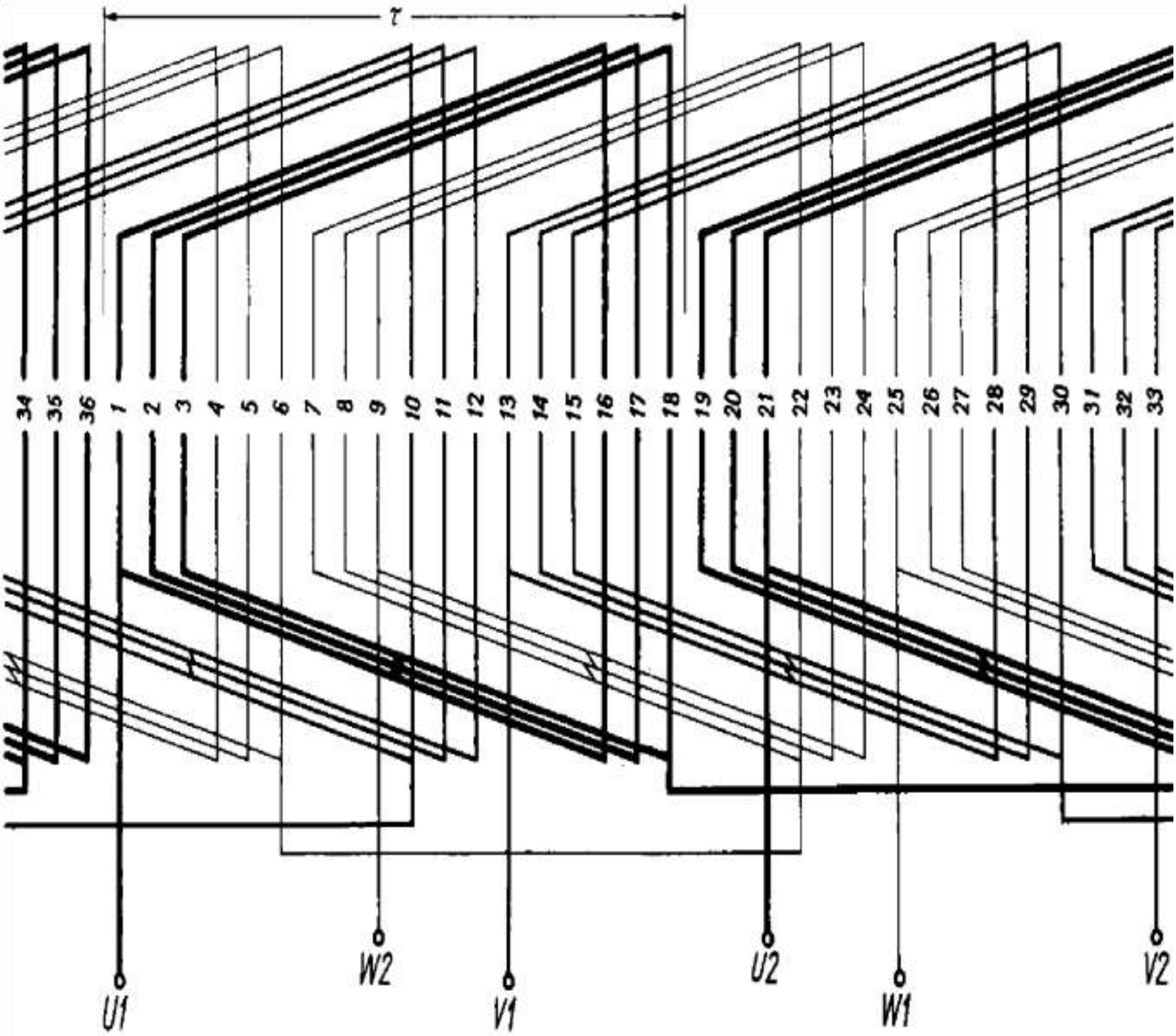


Figure. 38. Concentric Chain Group Winding
Slots = 36; Poles = 2; y = 13, 15, 17; q = 6



Dwa obwody równoległe

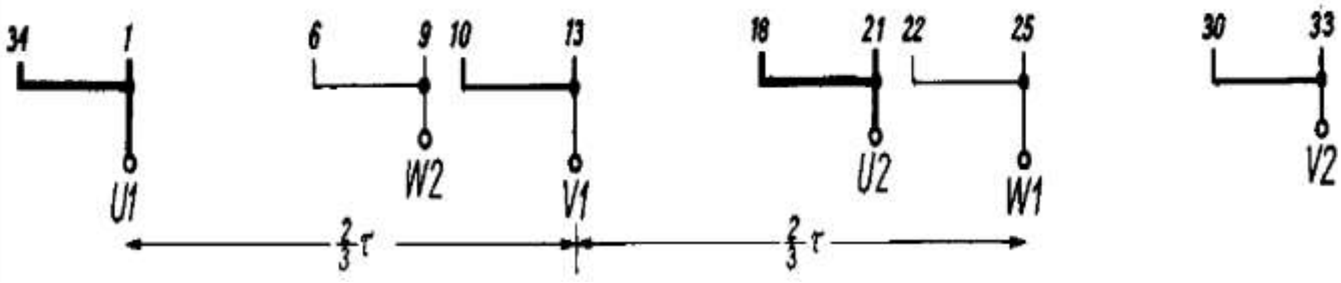
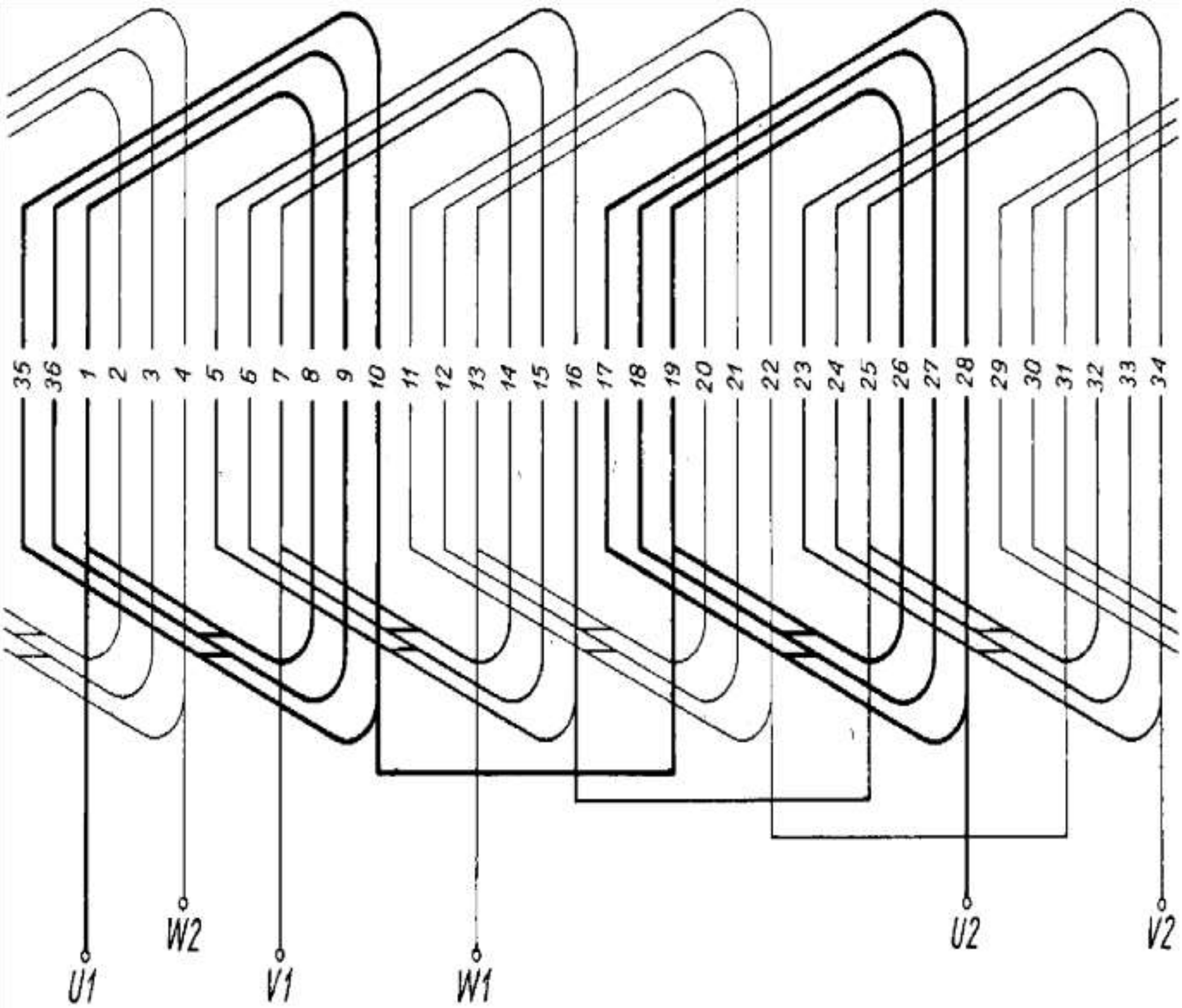


Figure. 39. Chain group Winding
Slots = 36; Poles = 2; y = 15; q = 6



Dwa obwody równoległe

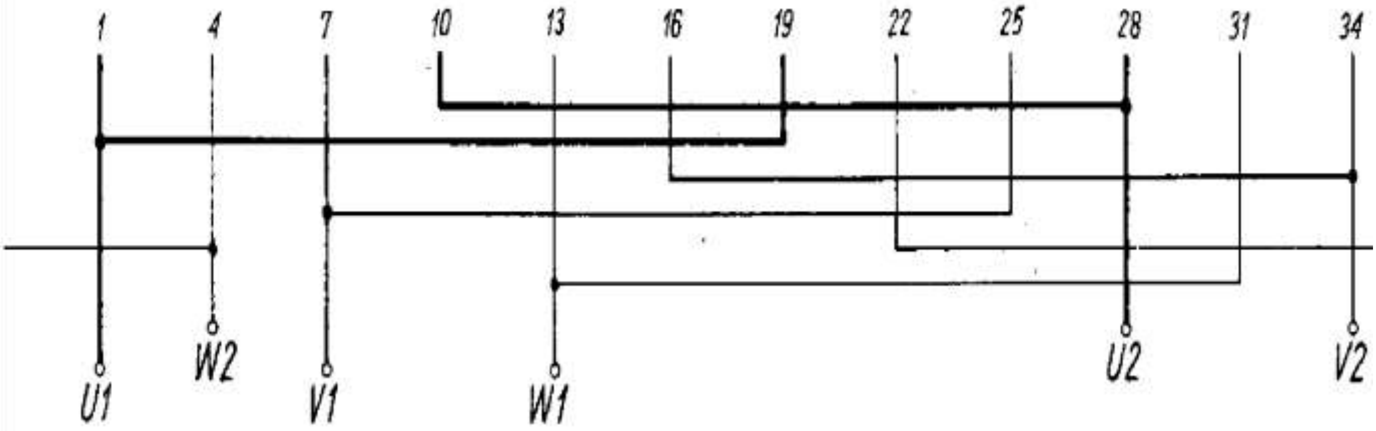
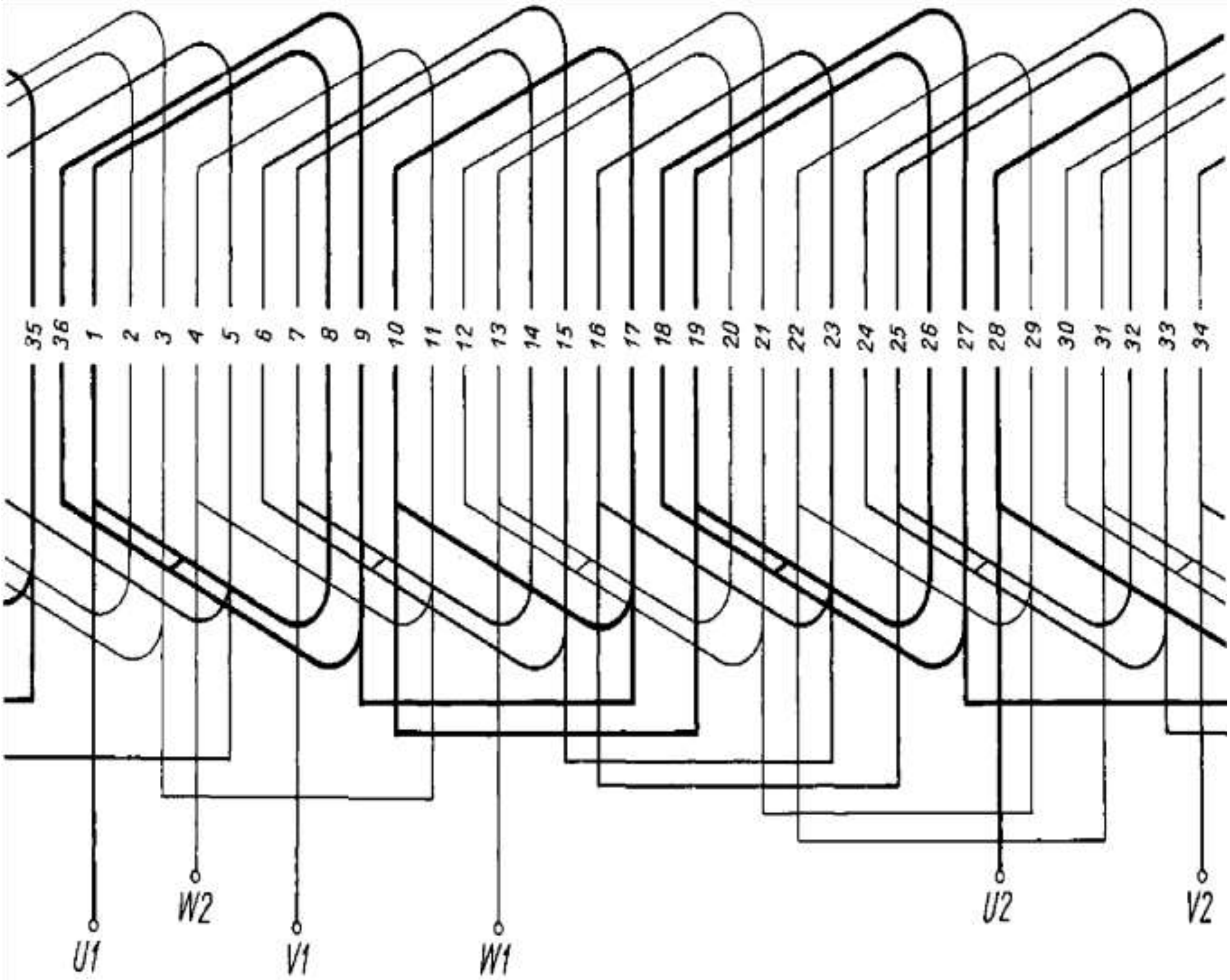


Figure. 40. Concentric Chain Group Winding
Slots = 36; Poles = 4; y = 7, 9, 11; q = 3



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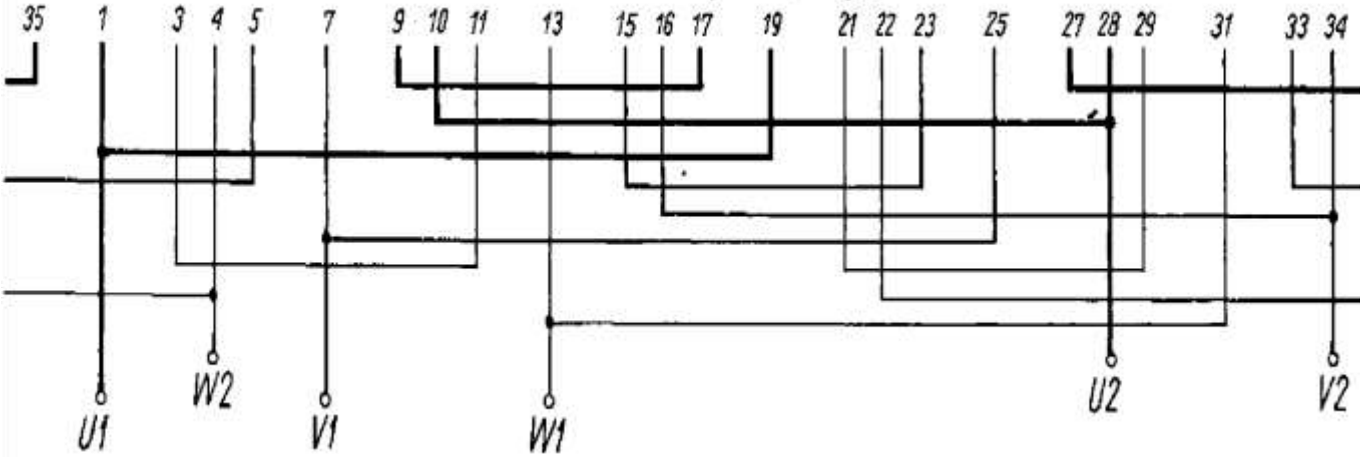
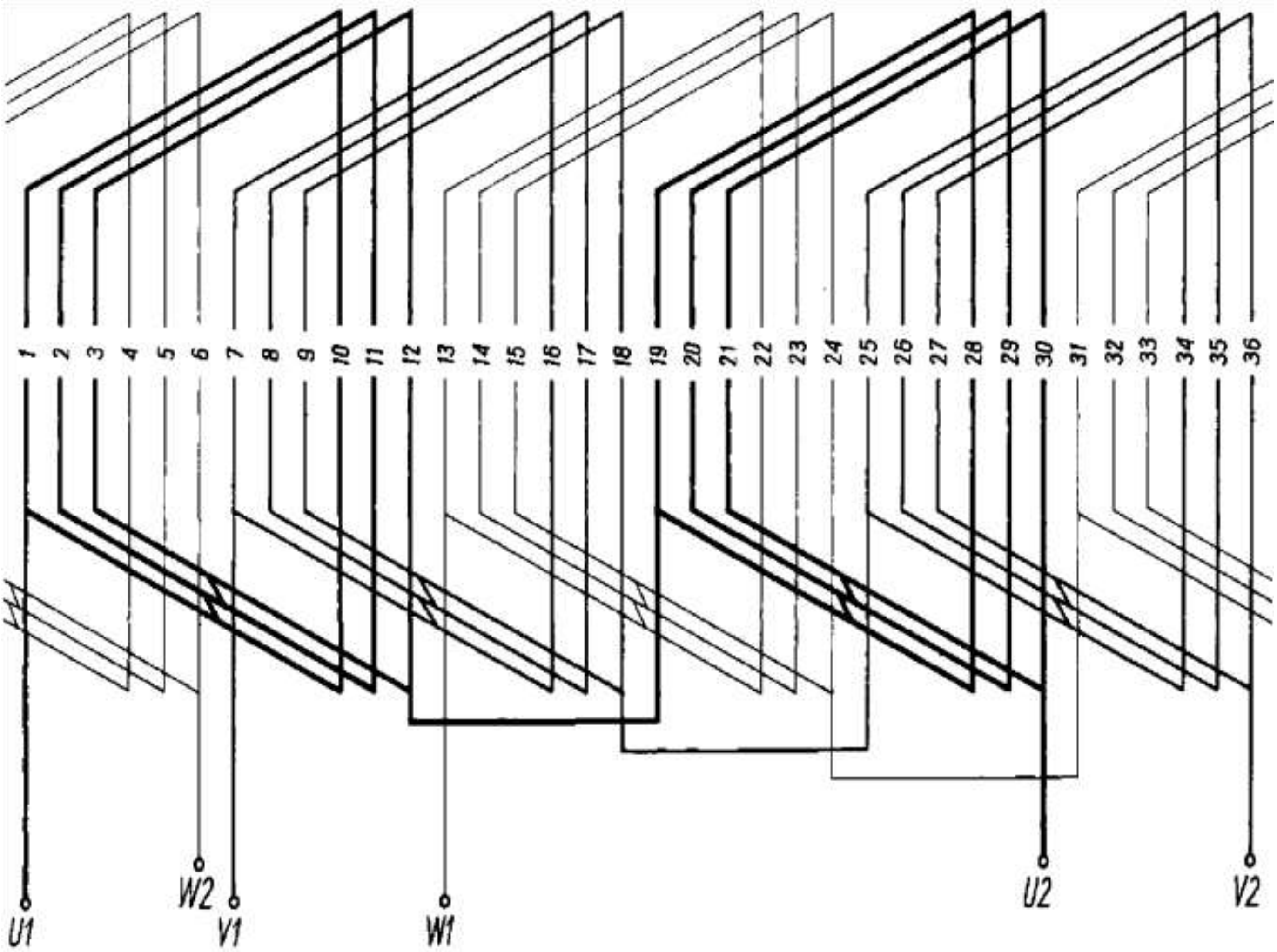


Figure. 40a. Concentric Chain Group with odd groups
Slots = 36; Poles = 4; y = 7, 9; q = 3



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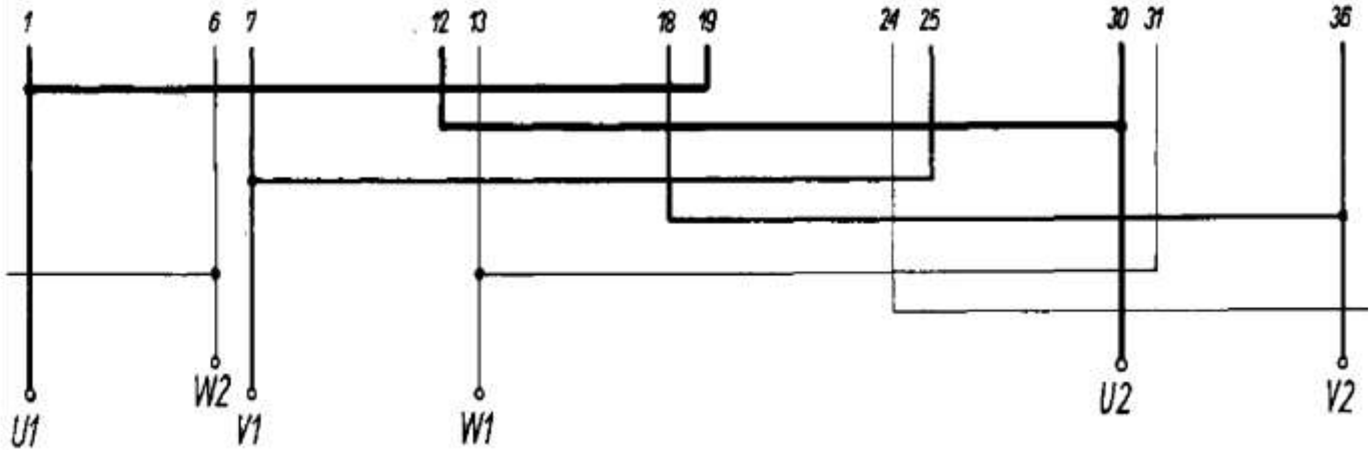
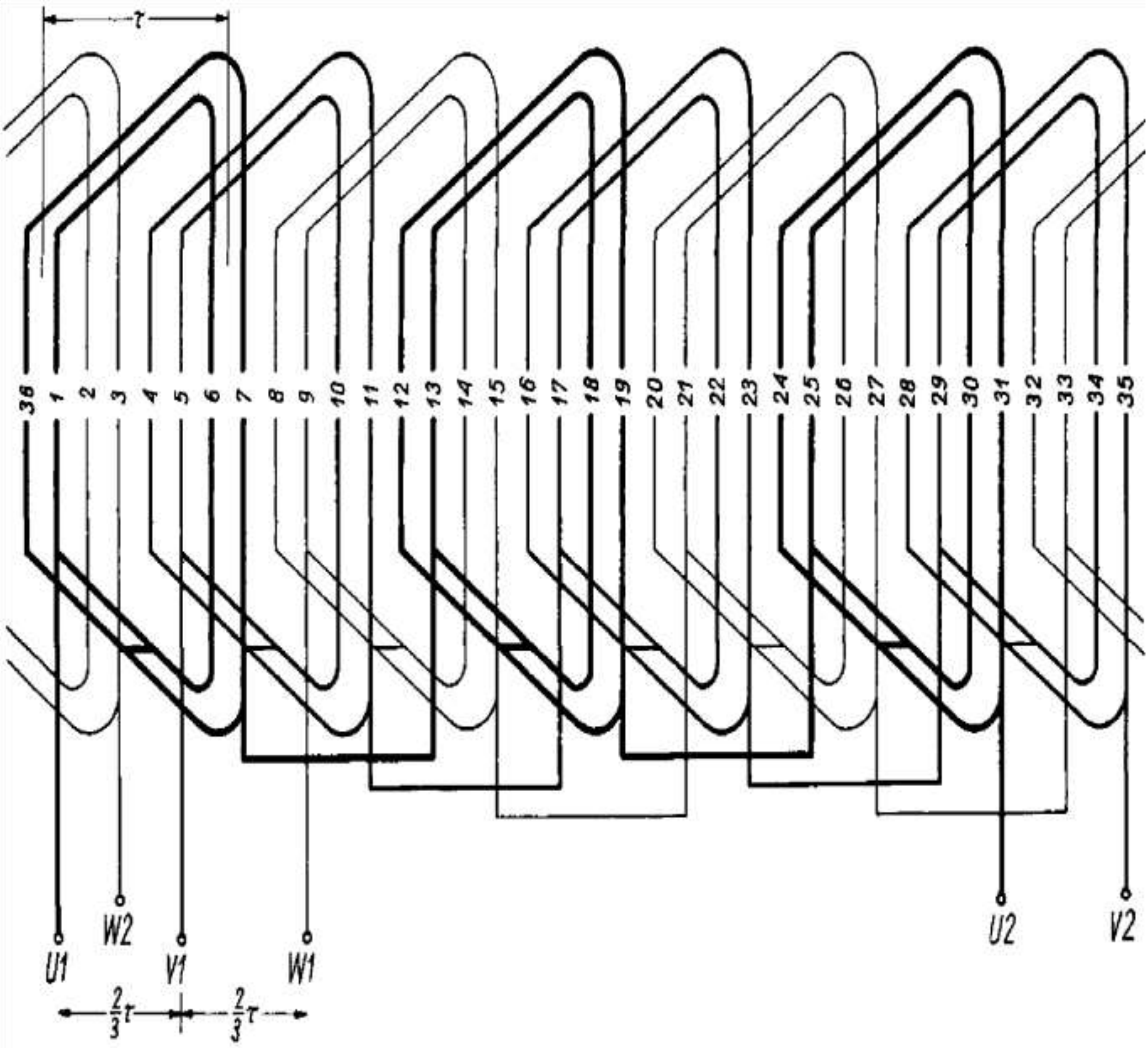


Figure. 41. Chain Group Winding
Slots = 36; Poles = 4; y = 9; q = 3



Trzy obwody równoległe

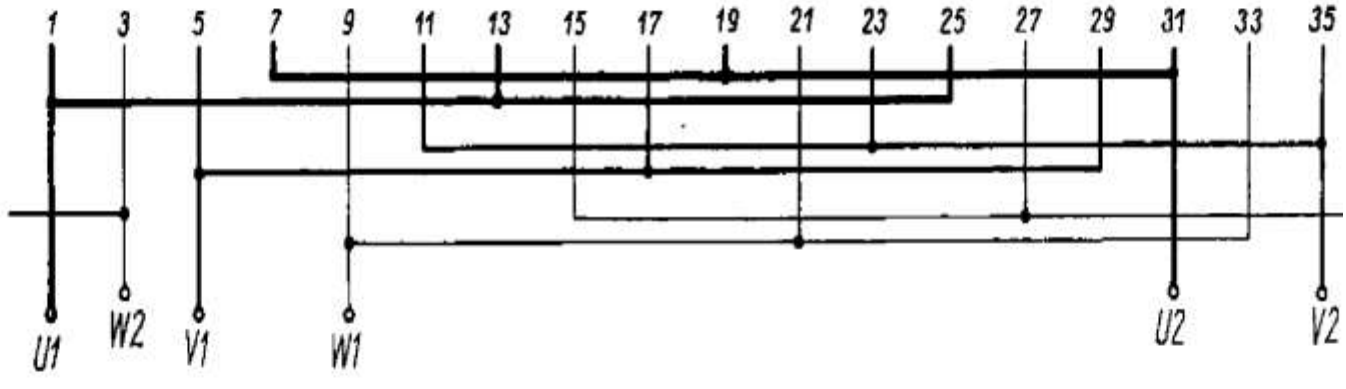
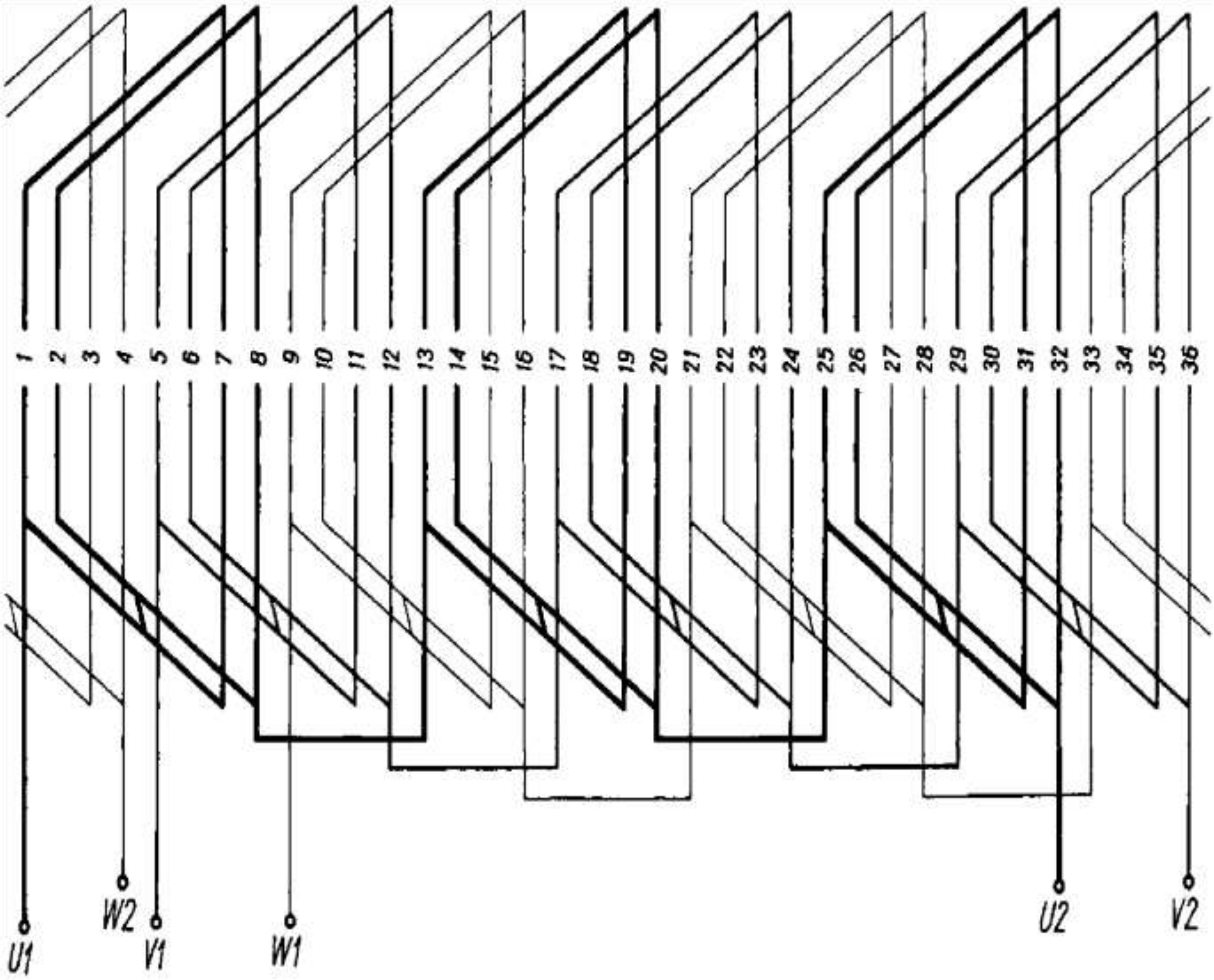


Figure. 42. Concentric Chain Group Winding
Slots = 36; Poles = 6; y = 5, 7; q = 2



Trzy obwody równoległe

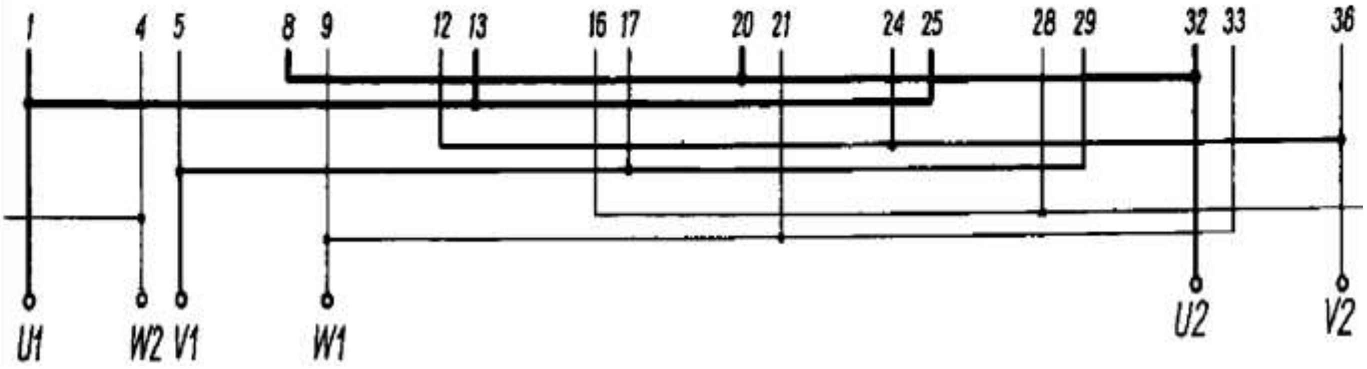


Figure. 43. Chain Group Winding
Slots = 36; Poles = 6; y = 6; q = 2

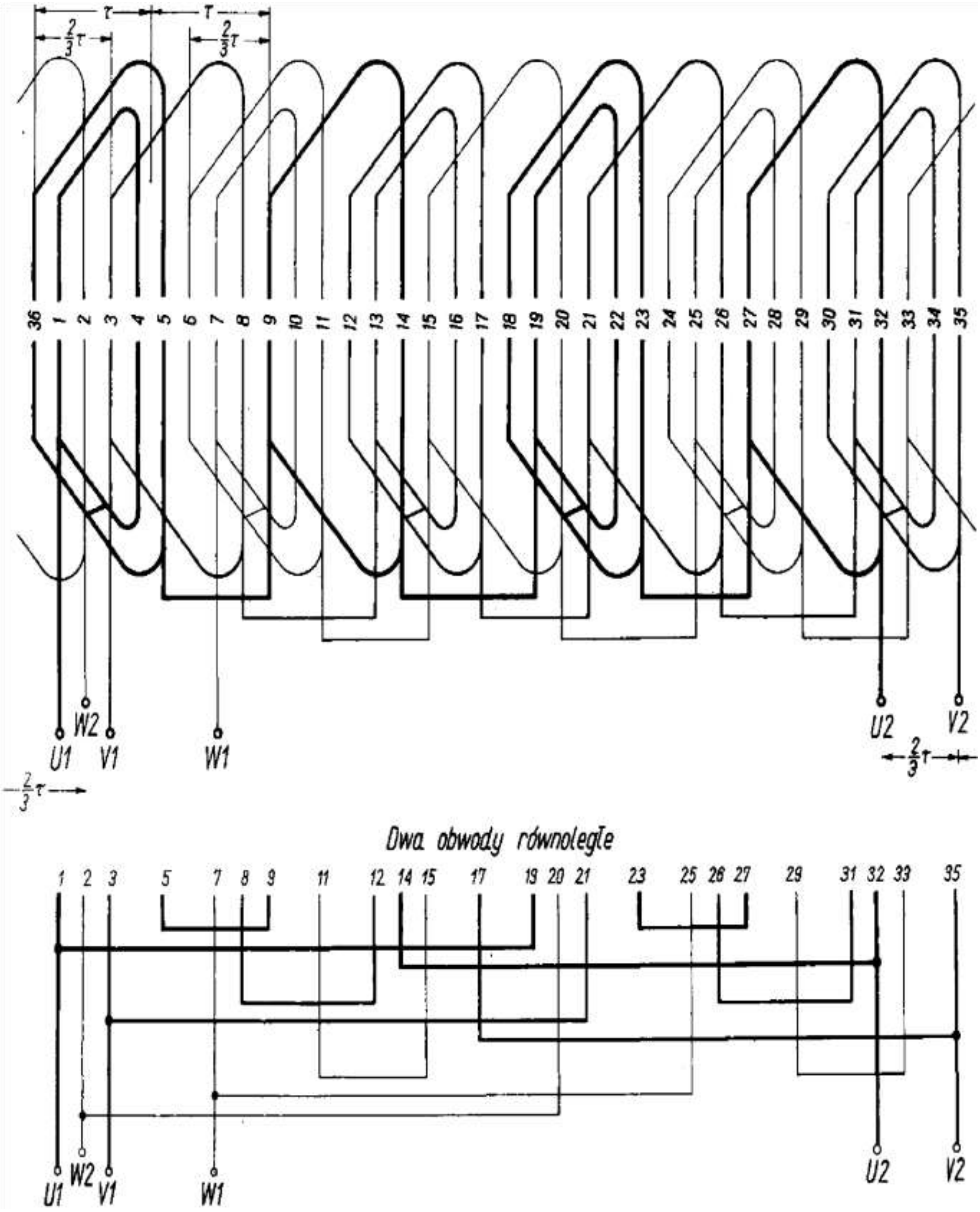
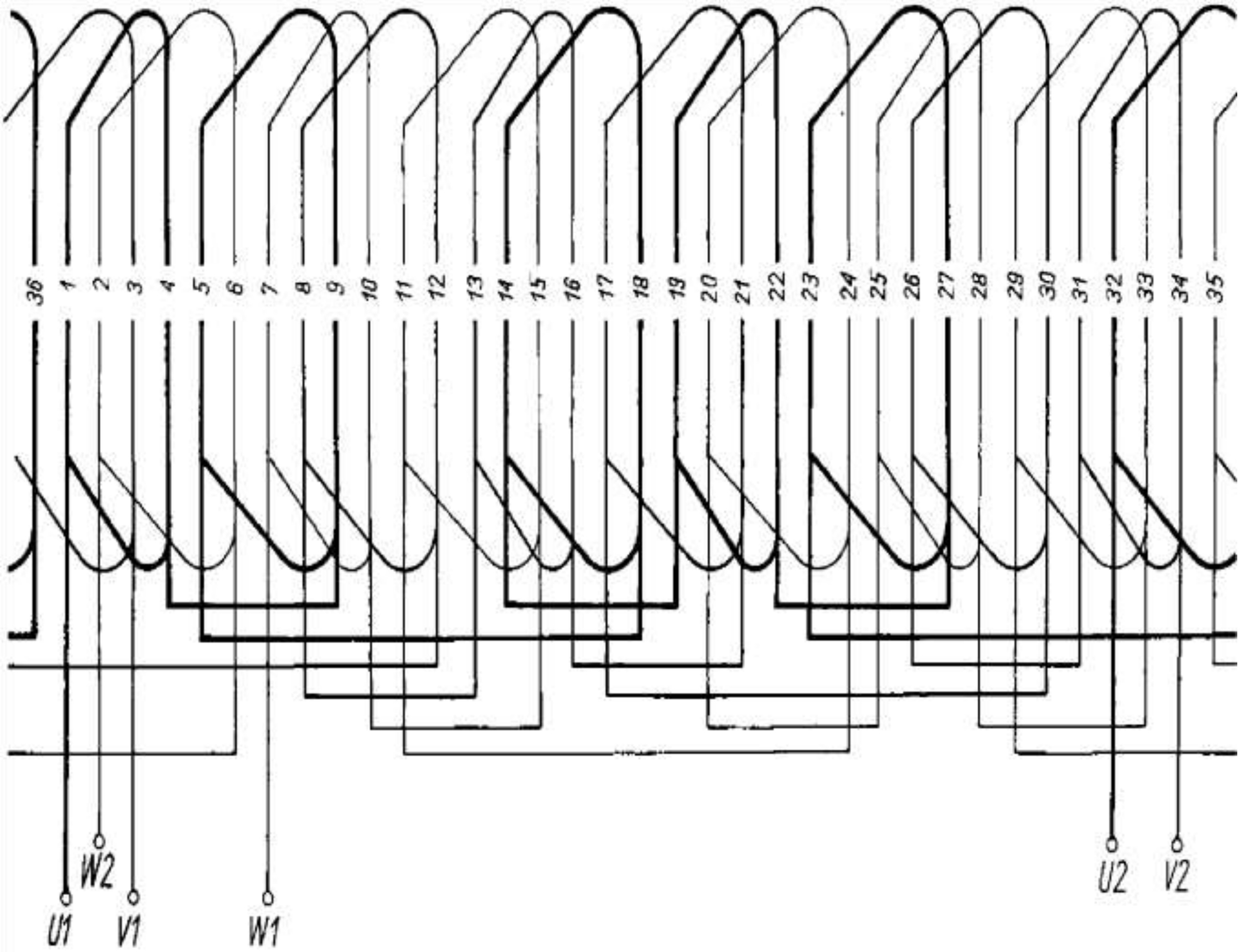


Figure. 44. Concentric Chain Group Winding with odd Groups
Slots = 36; Poles = 8; y = 3, 5, q = 1 $^1/_2$



Dwa obwody równoległe

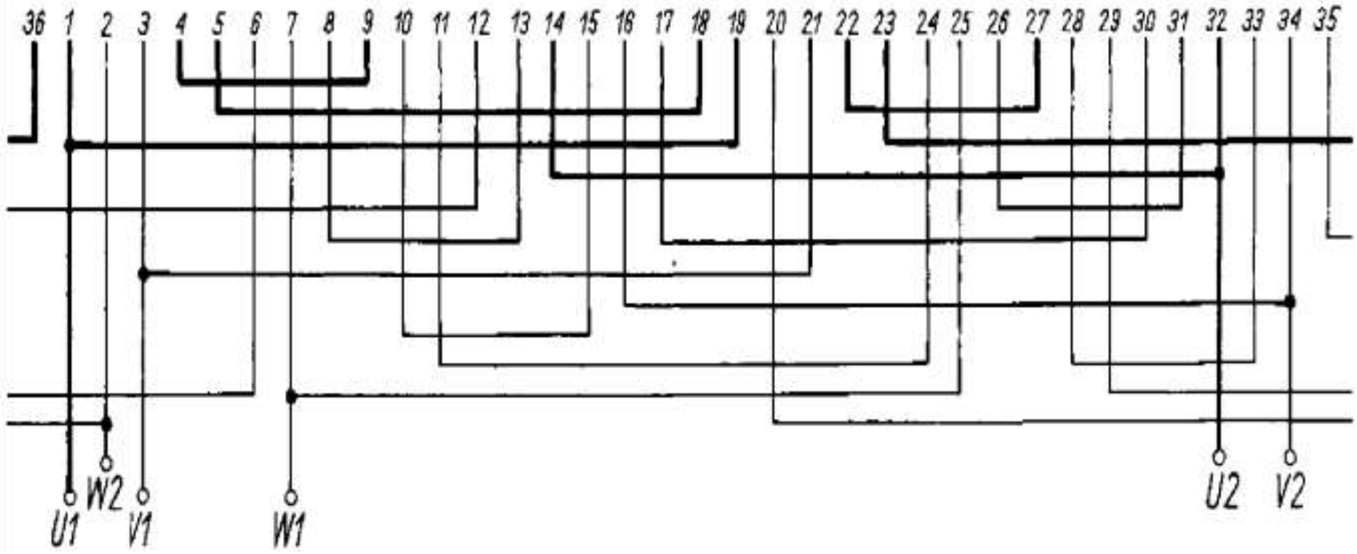


Figure. 44a. Chain Group Winding with odd groups
Slots = 36; Poles = 8; y = 3, 4; q = 1 $^{1}/_{2}$

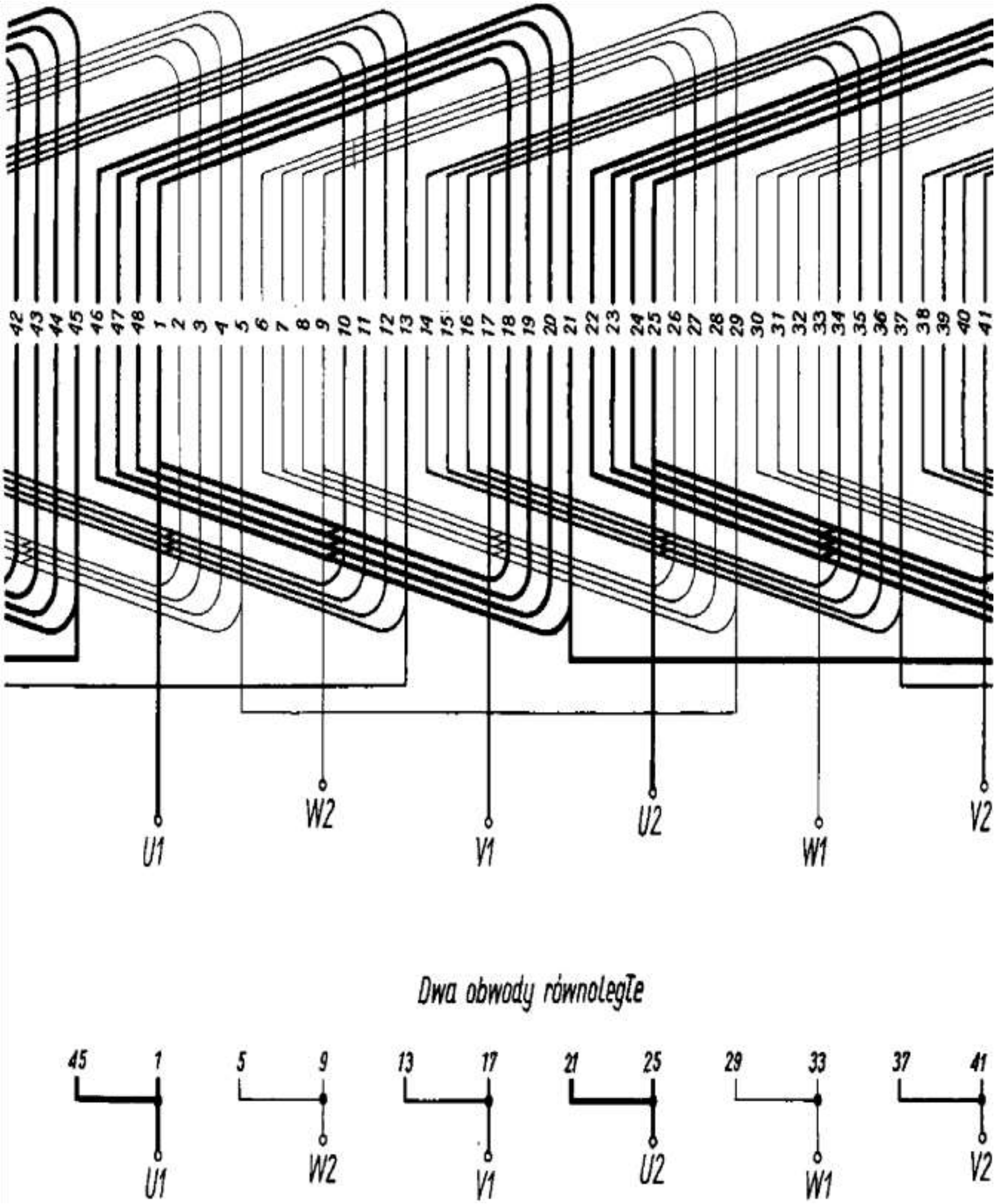


Figure. 45. Concentric Chain Group Winding
Slots = 48; Poles = 2; y = 17, 19, 21, 23; q = 8

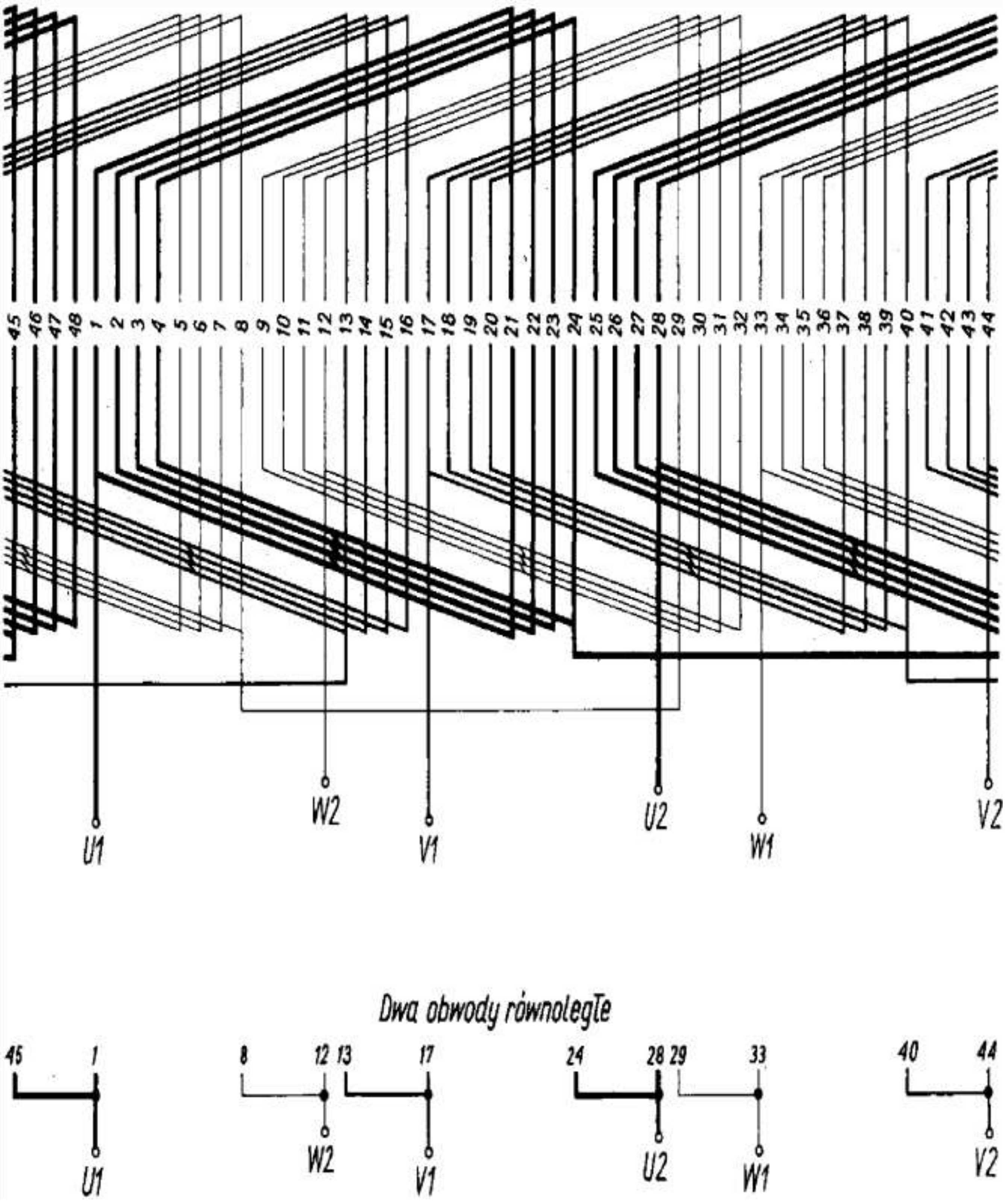
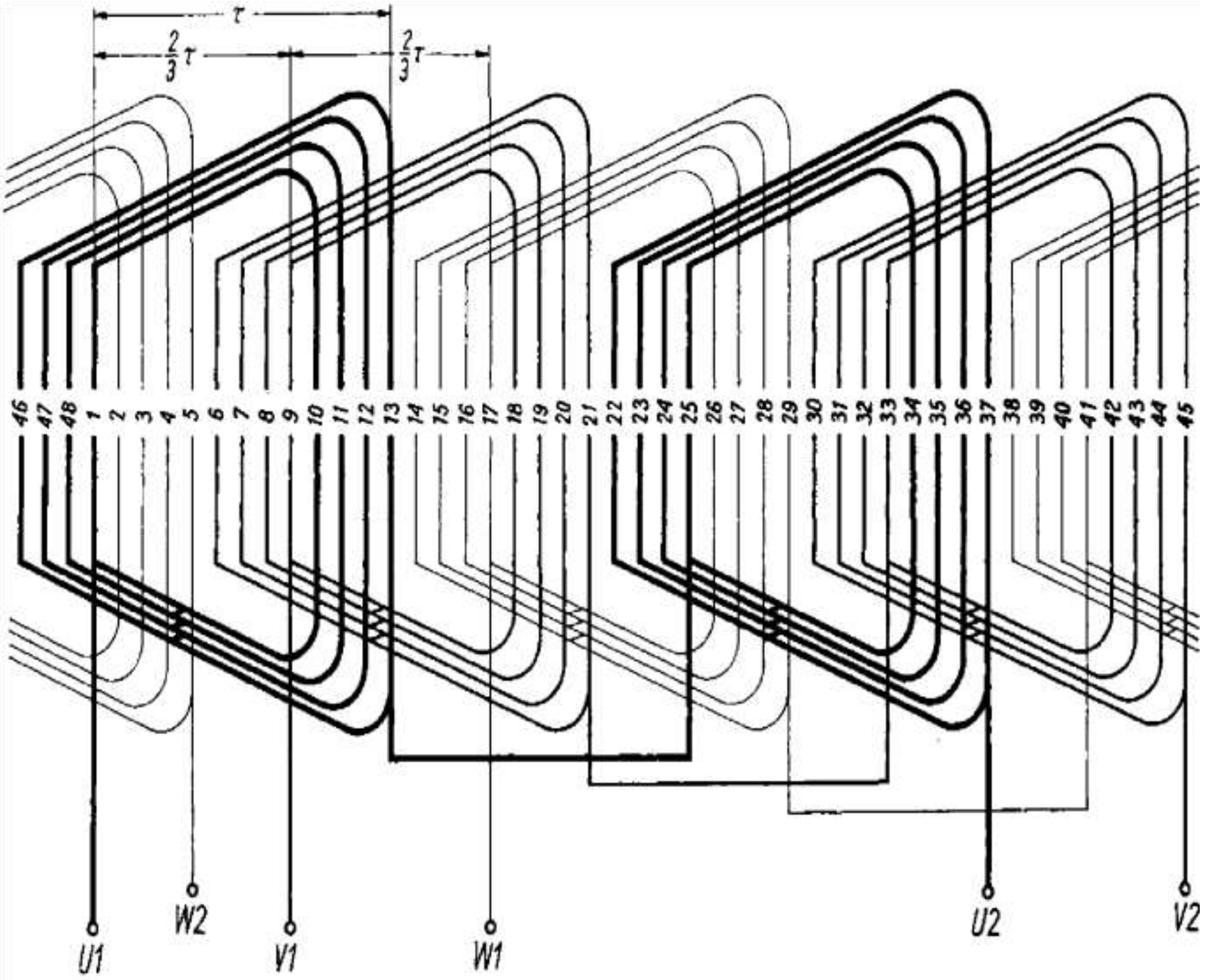


Figure. 46. Chain Group Winding
Slots = 48; Poles = 2; y = 20; q = 8



Dwa obwody równoległe

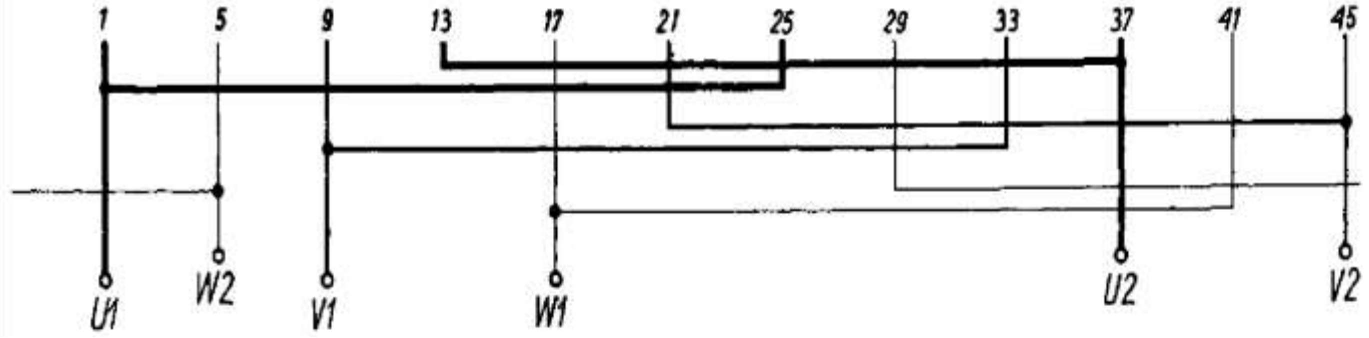
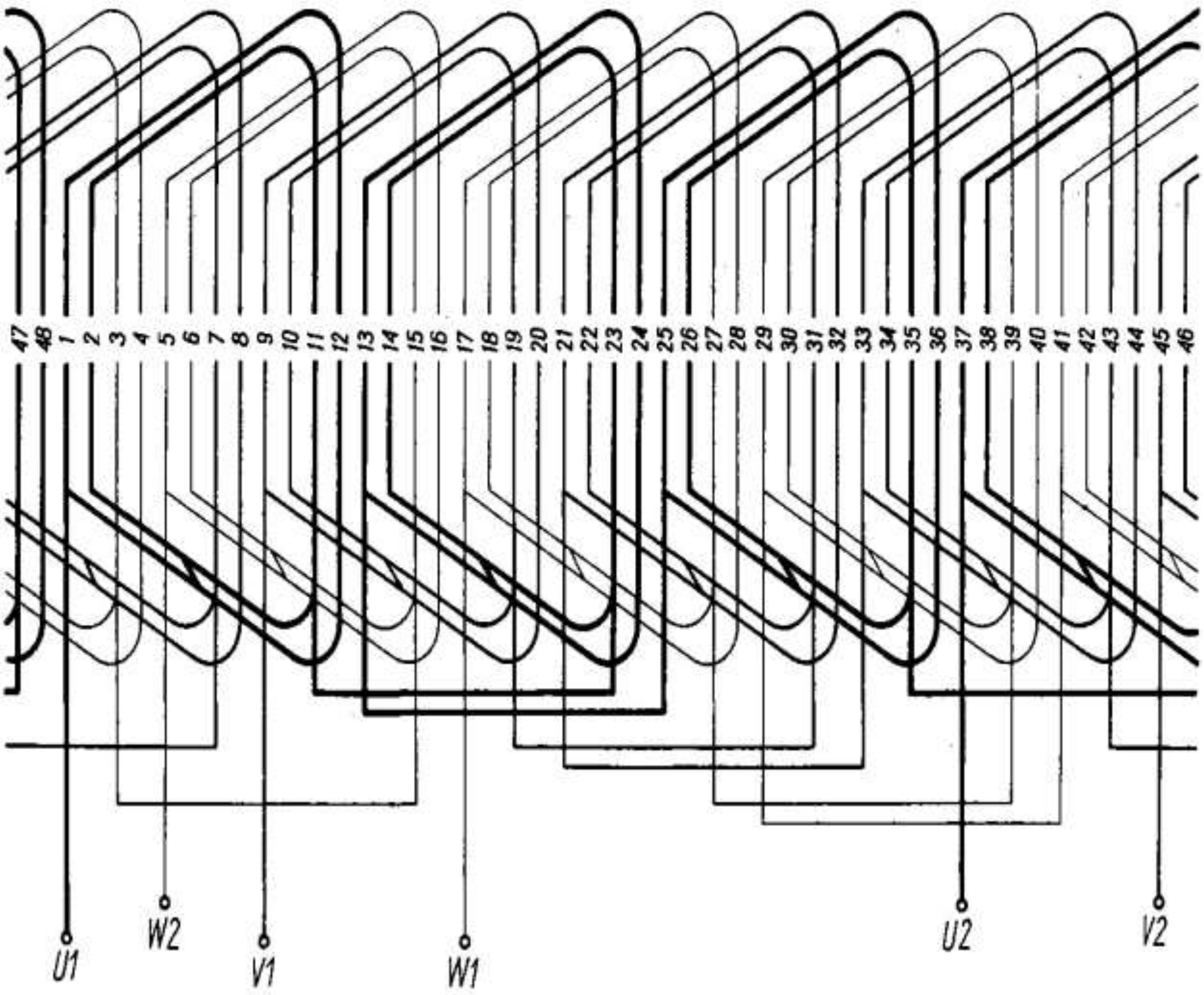


Figure. 47. Concentric Chain Group Winding
Slots = 48; Poles = 4; y = 9, 11, 13, 15; q = 4



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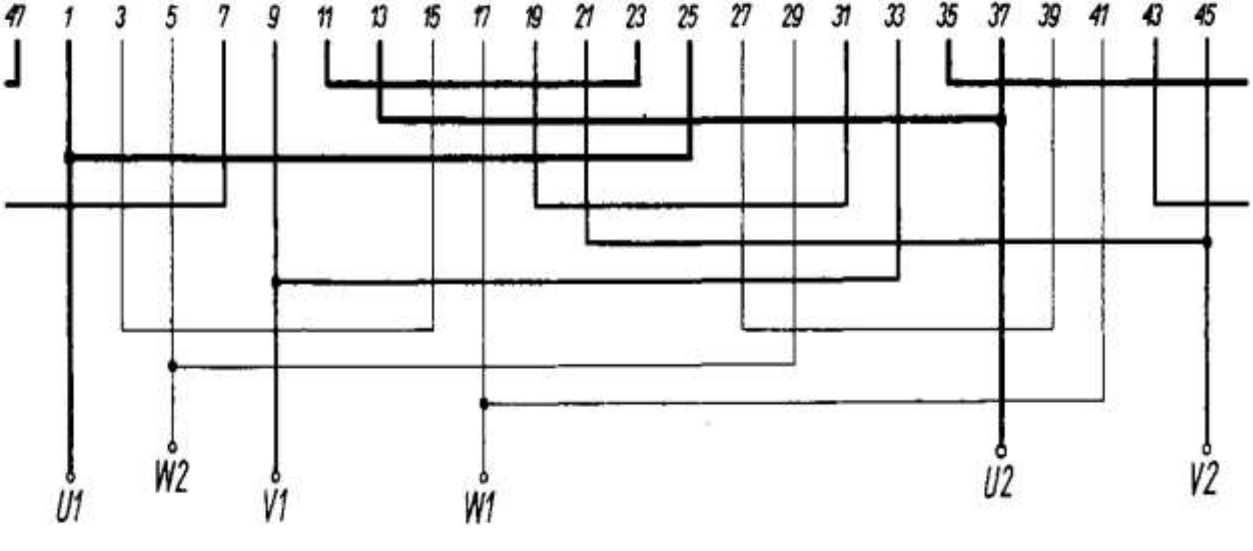
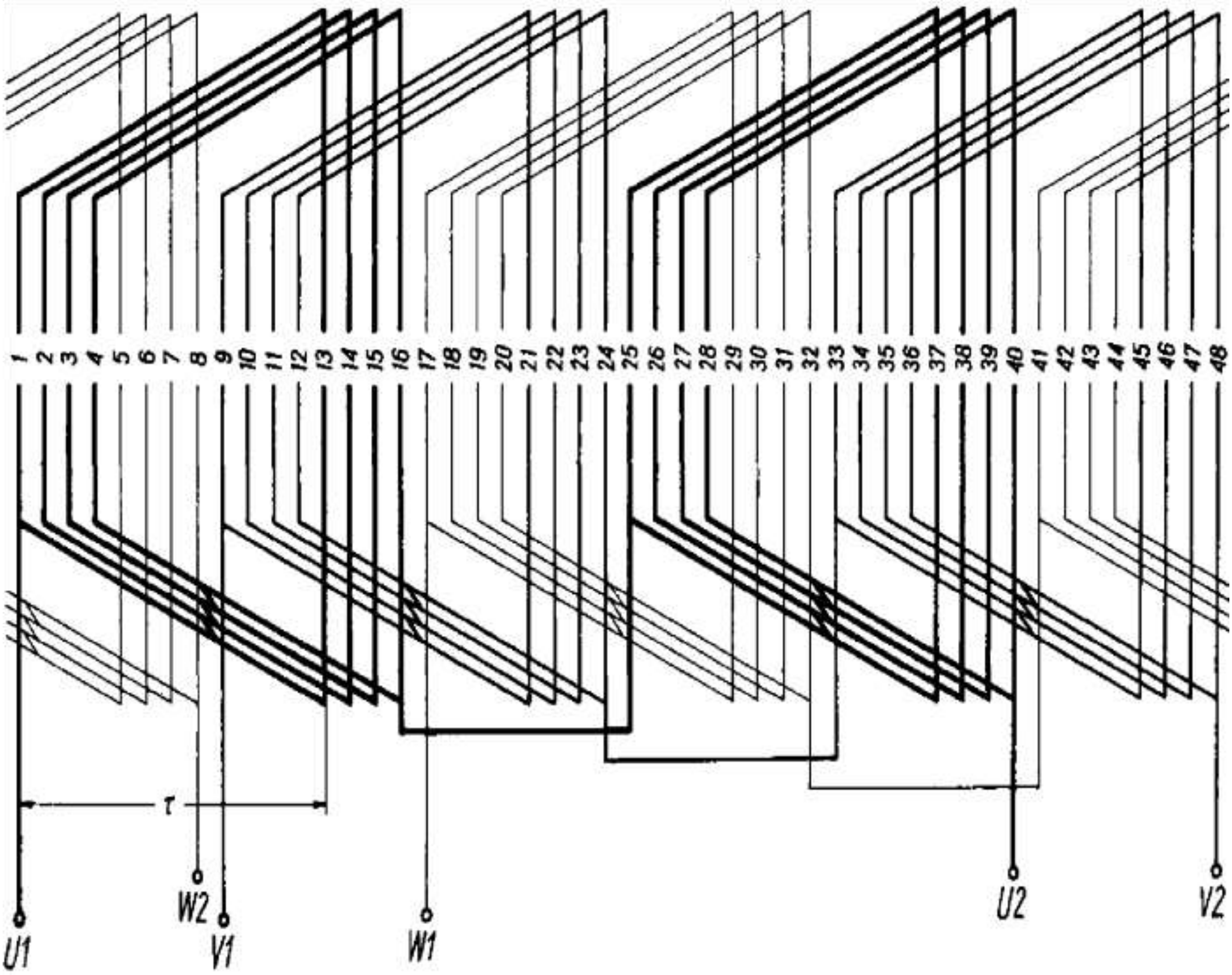


Figure. 48. Concentric Chain Group Winding
Slots = 48; Poles = 4; y = 9, 11; q = 4



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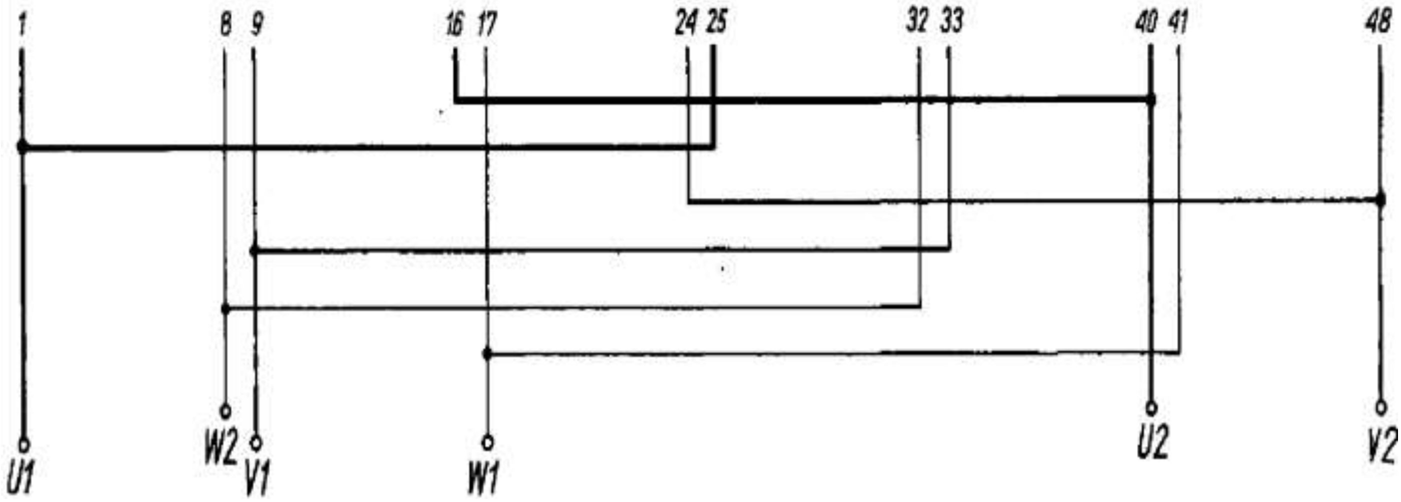
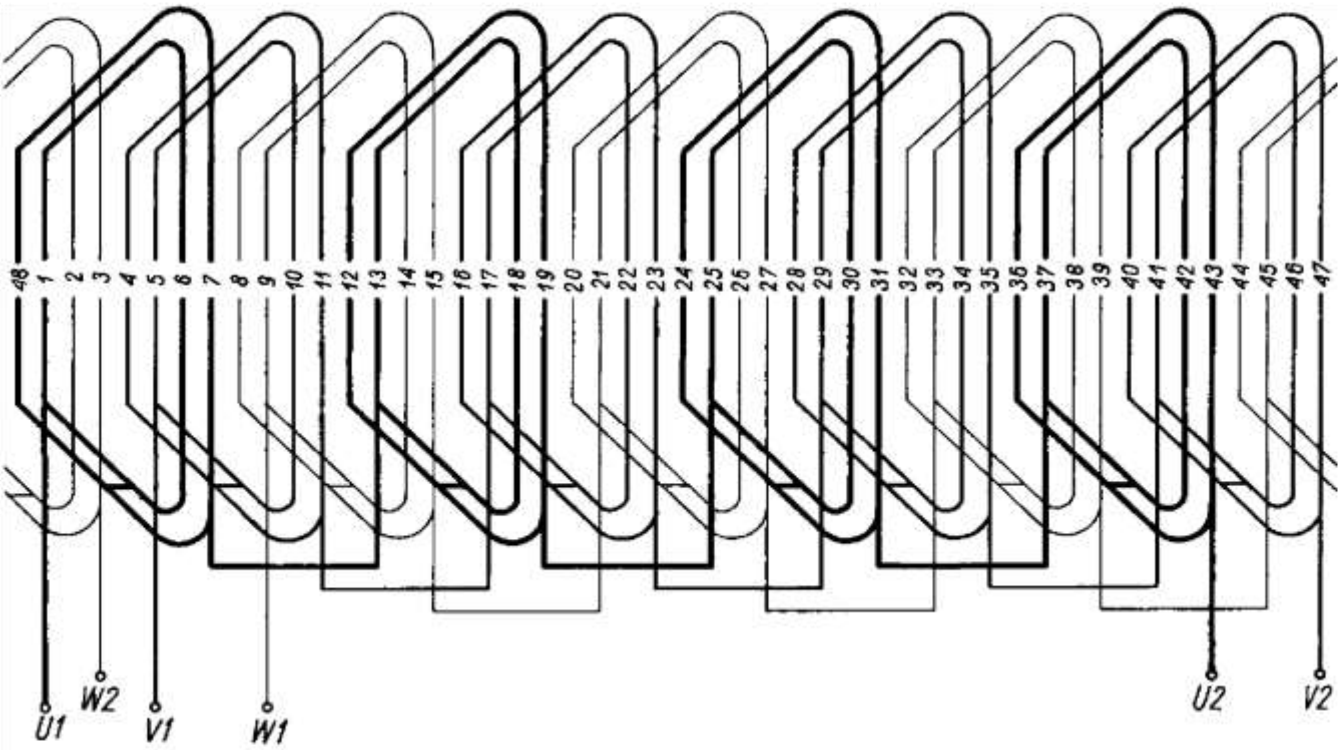


Figure. 49. Chain Group Winding
Slots = 48; Poles = 4; y = 12; q = 4



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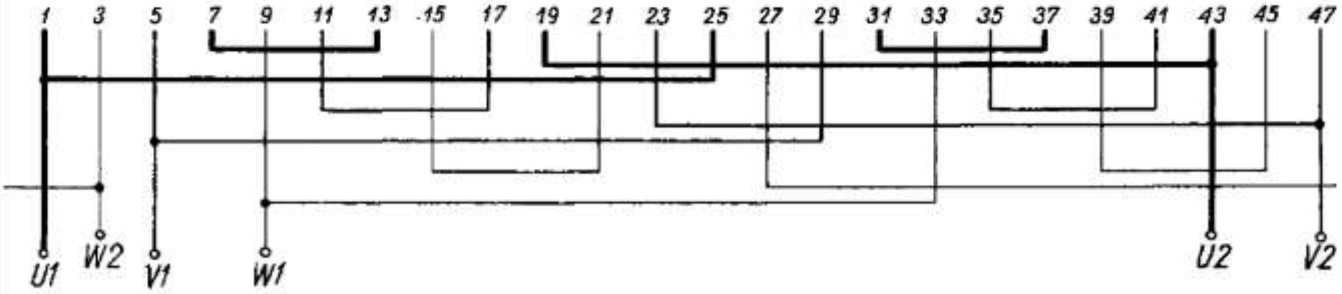


Cztery obwody równoległe

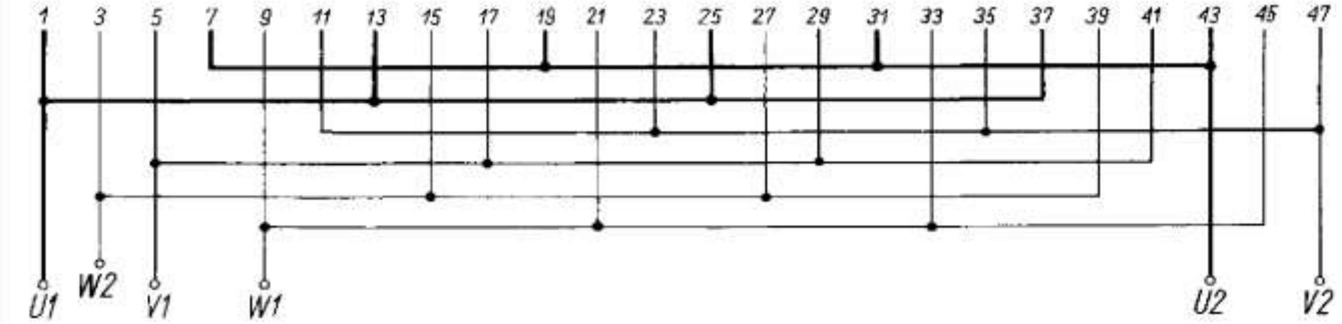


Figure. 50. Concentric Chain Group Winding
Slots = 48; Poles = 8; y = 5, 7; q = 2

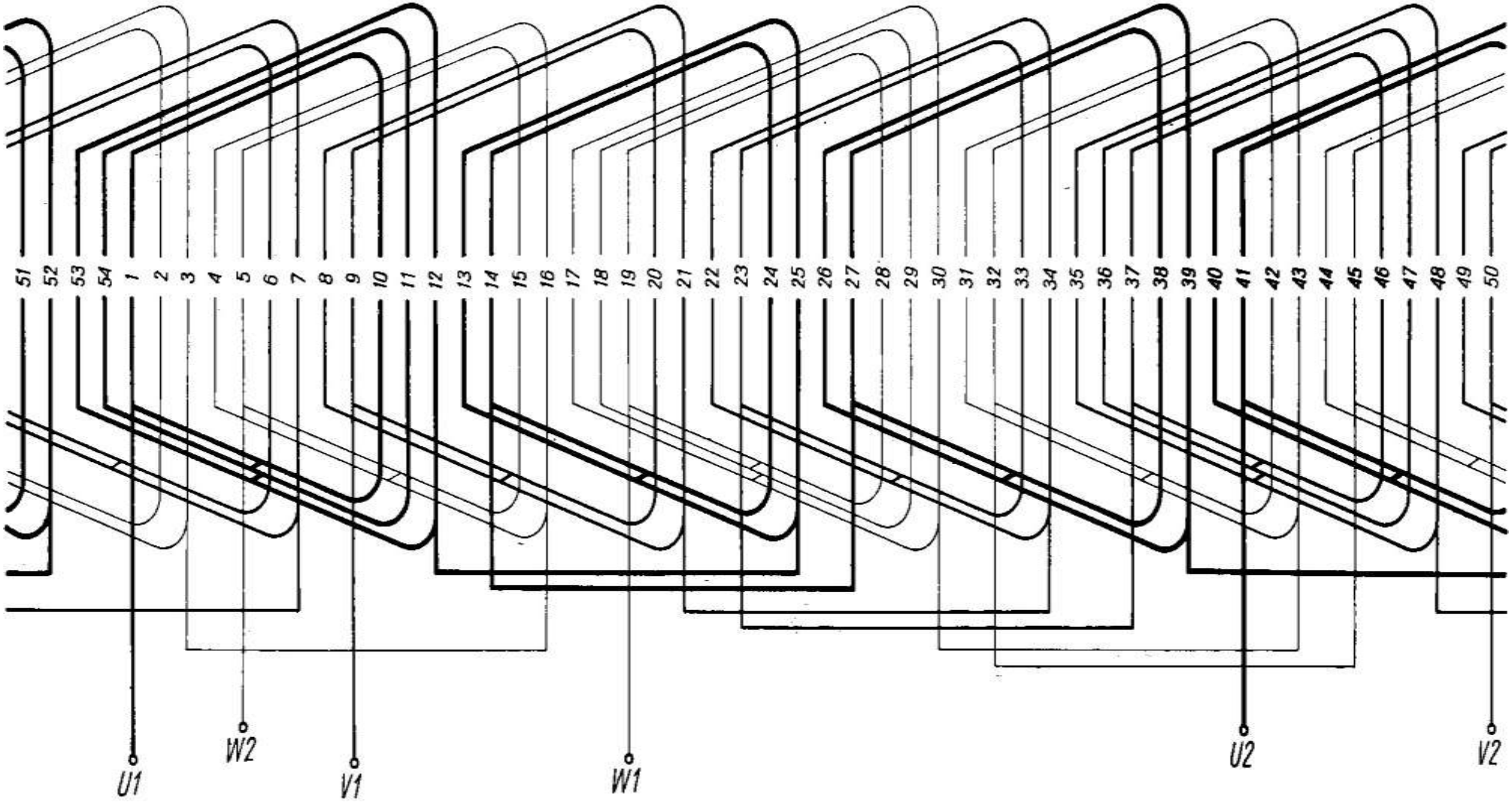


Figure. 51. Concentric Chain Group Winding with odd Groups
Slots = 54; Poles = 4; y = 9, 10, 11, 12, 13; q = $4^1/_2$

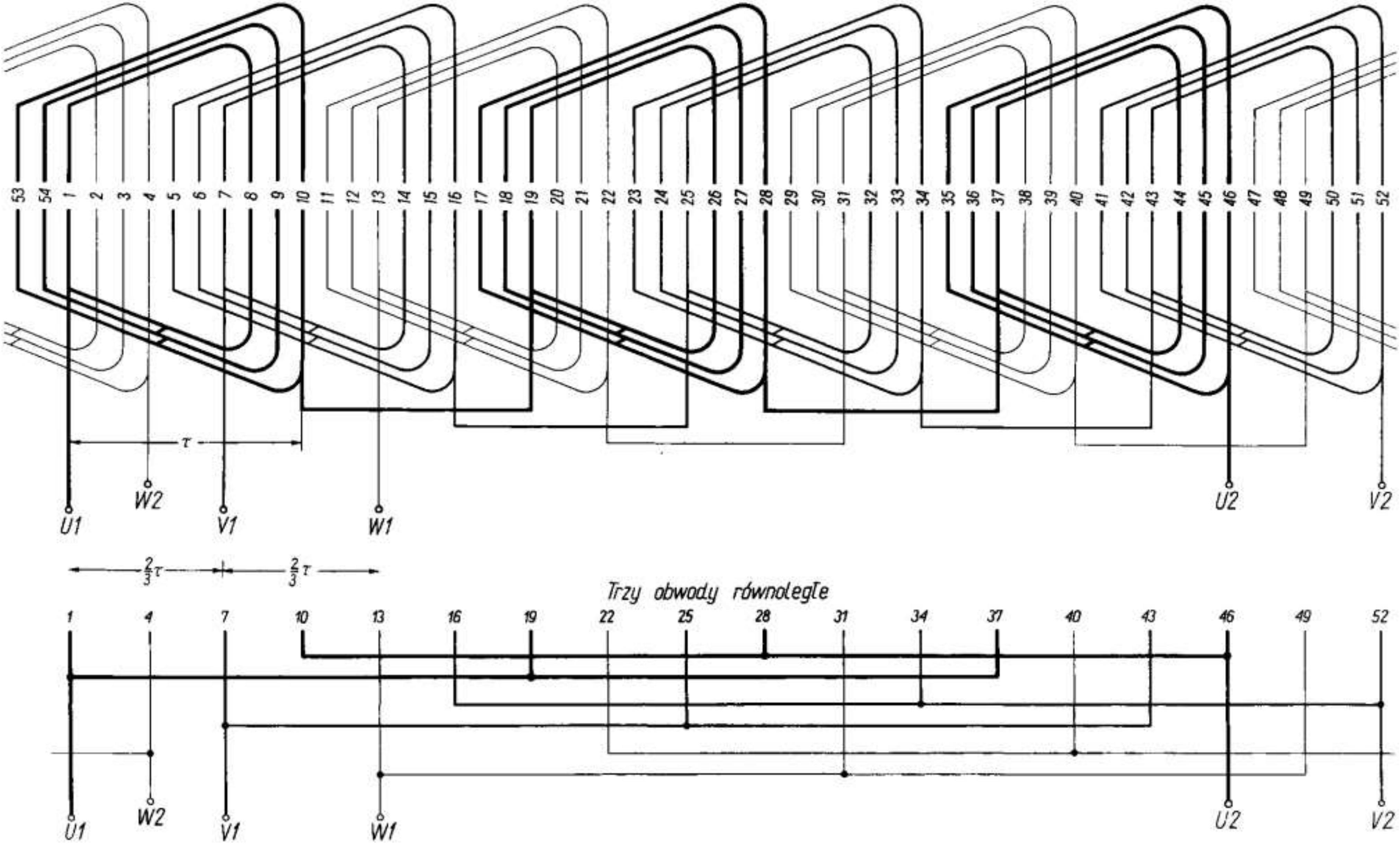
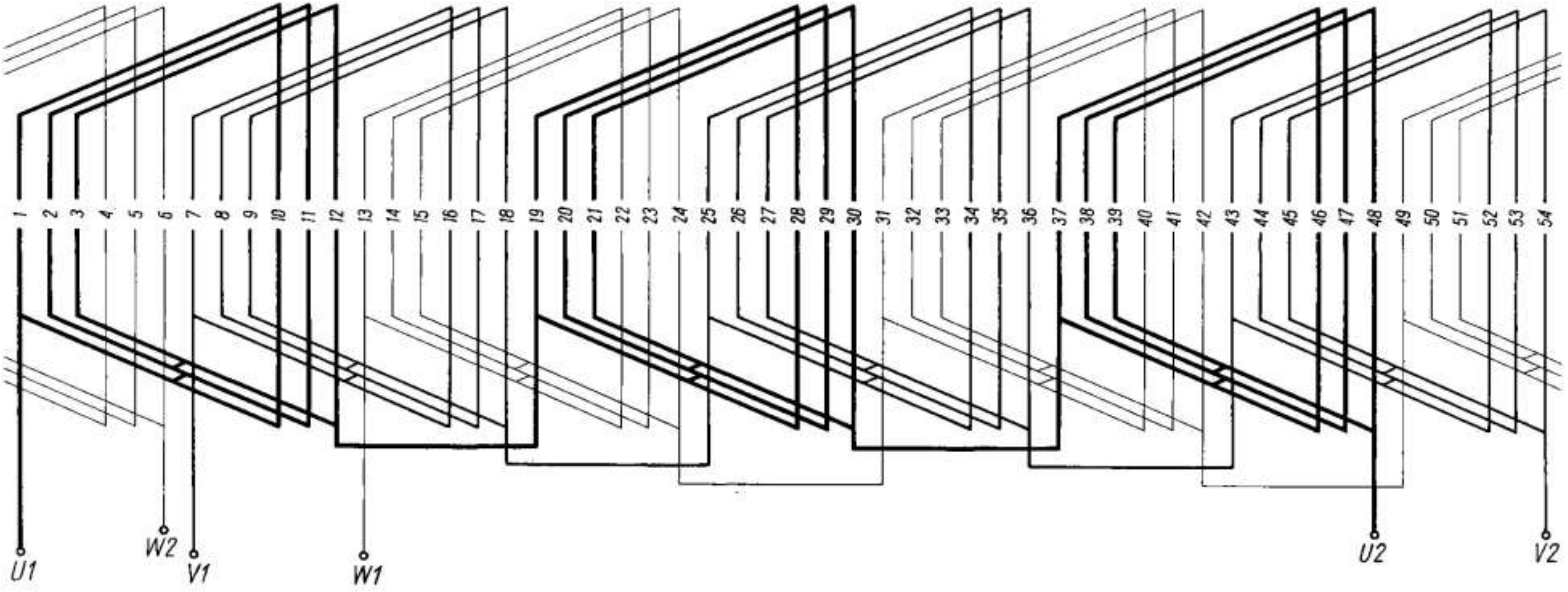


Figure. 52. Concentric Chain Group Winding
Slots = 54; Poles = 6; y = 7, 9, 11; q = 3



Trzy obwody równoległe

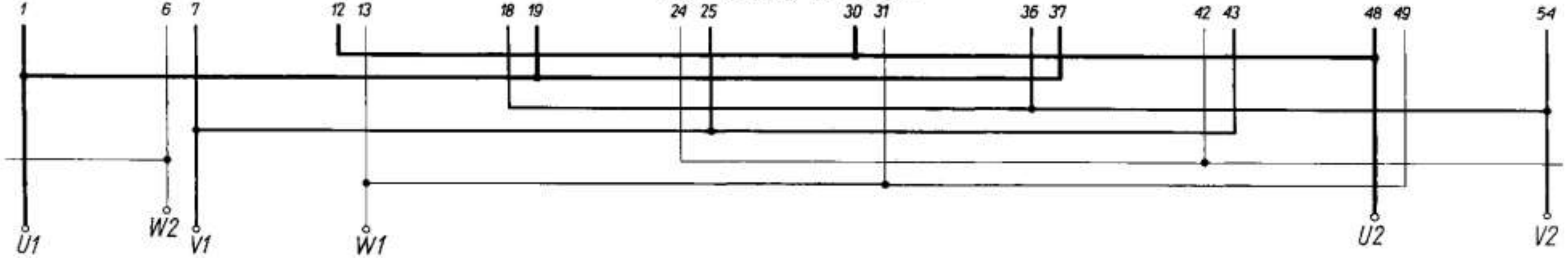


Figure. 53. Concentric Chain Group Winding
Slots = 54; Poles = 6; y = 9; q = 3

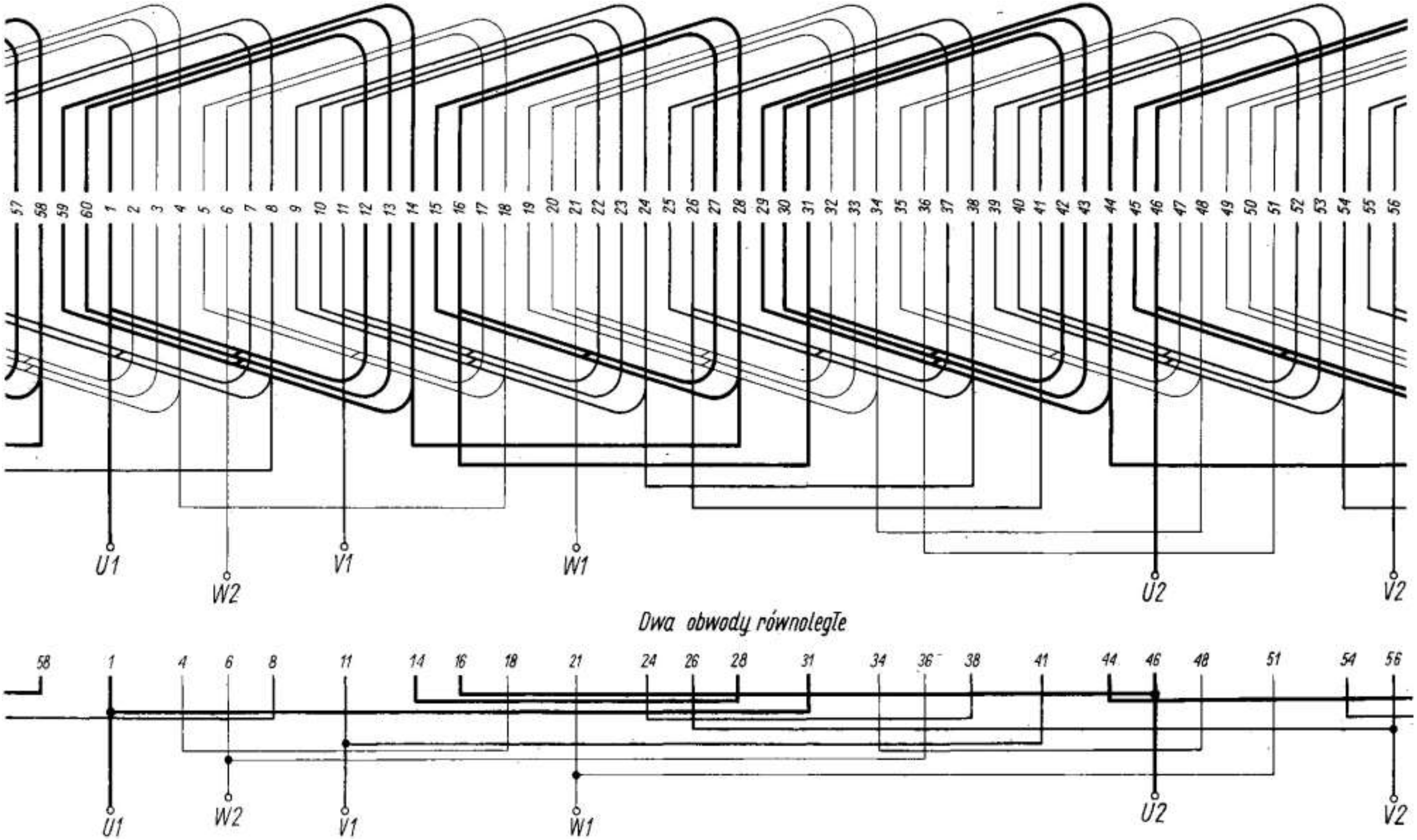
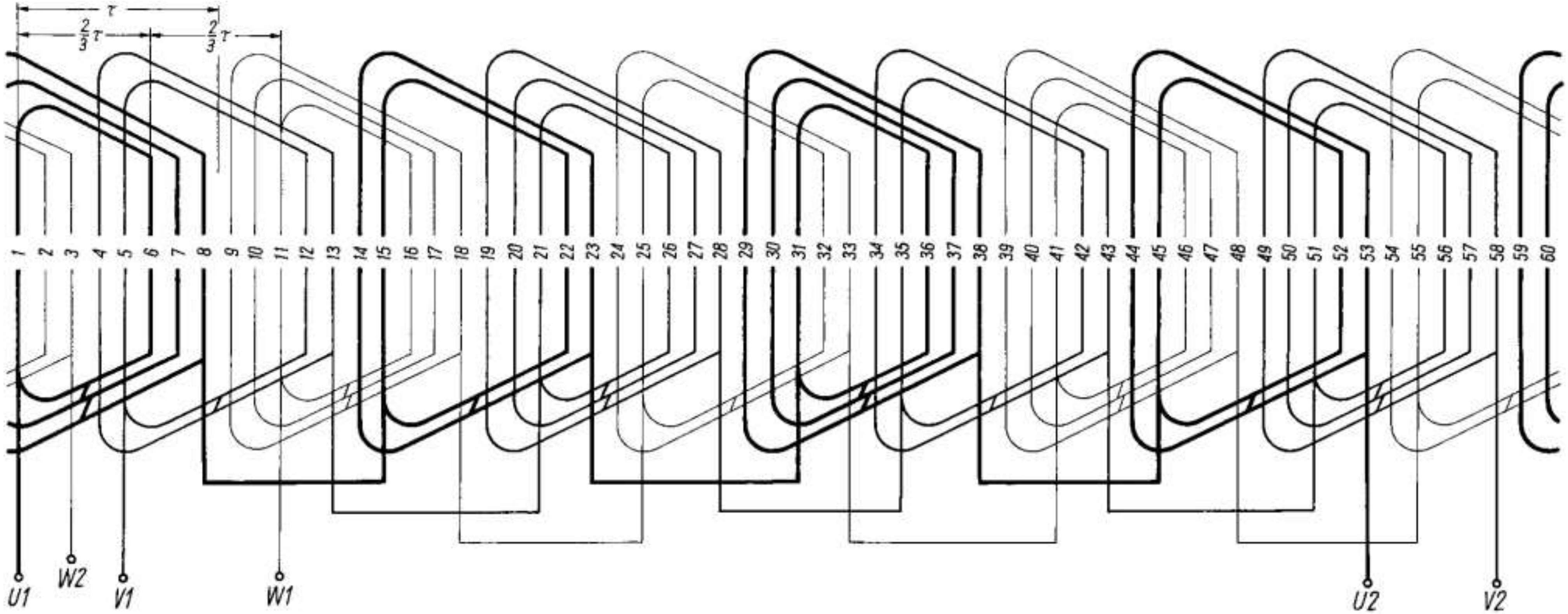


Figure. 54. Concentric Chain Group Winding with odd groups
Slots = 60; Poles = 4; y = 11, 13, 15; q = 5



Dwa obwody równoległe

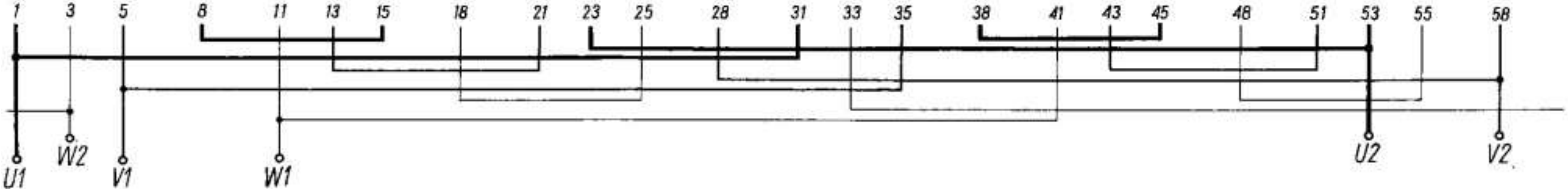


Figure. 55. Concentric Chain Group Winding with odd groups
Slots = 60; Poles = 8; y = 5, 7, 9; q = $2\,^{1}/_{2}$

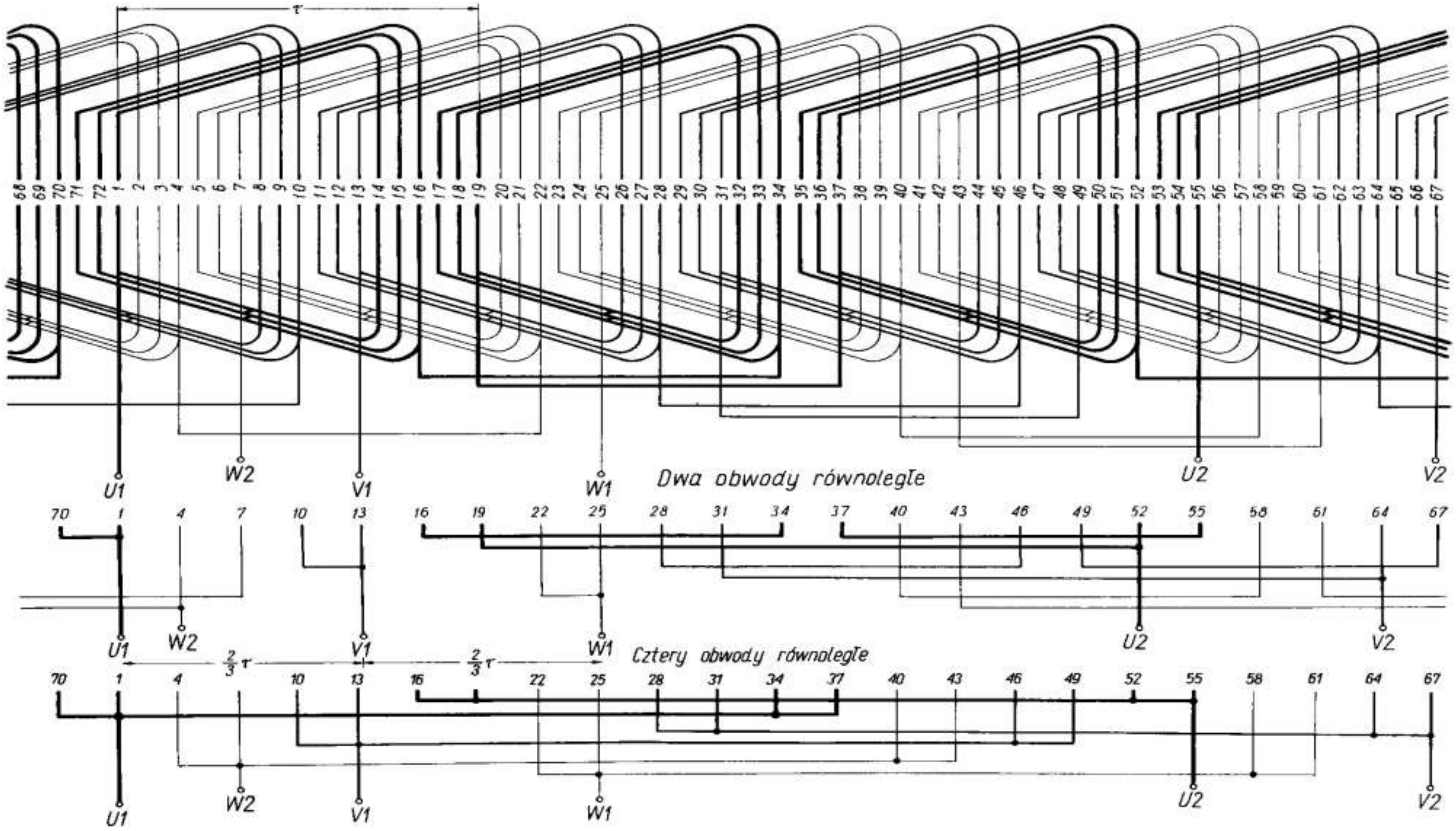
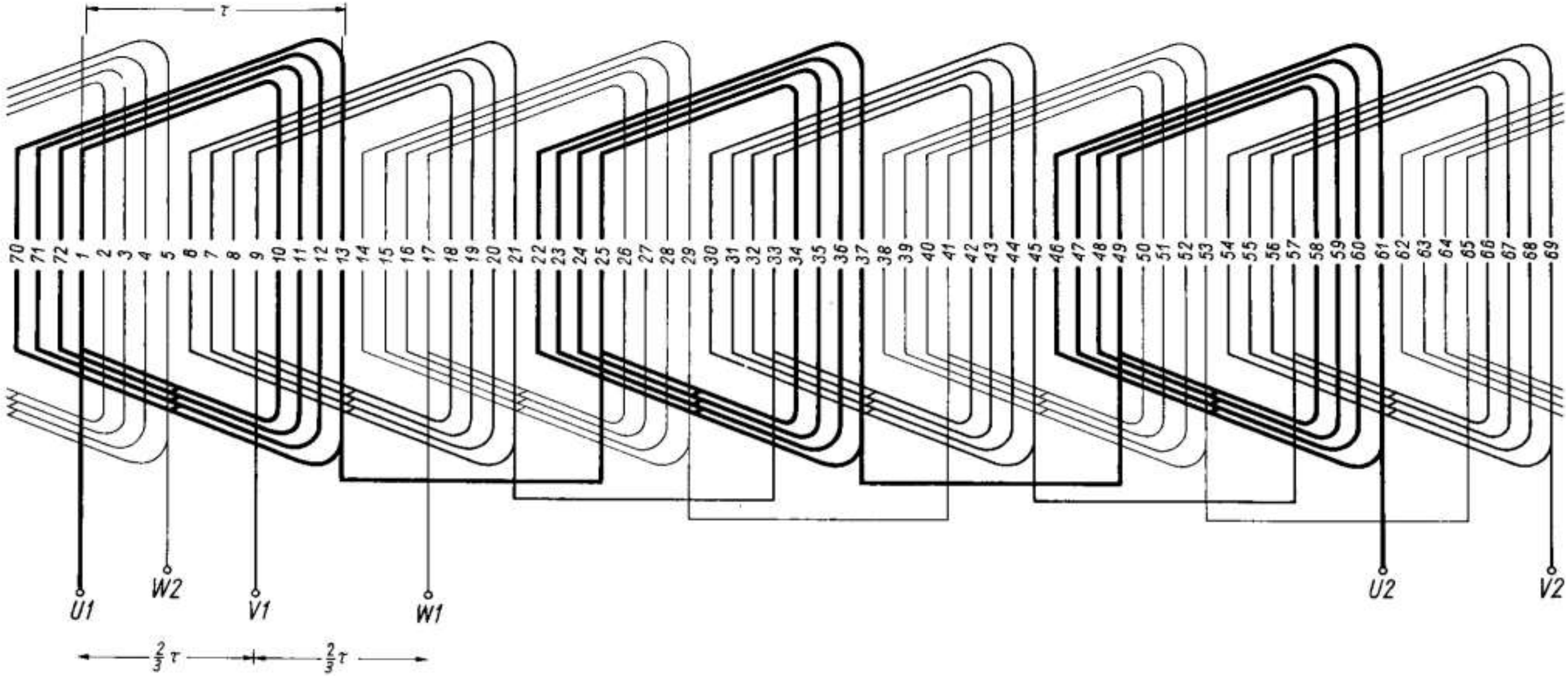


Figure. 56. Concentric Chain Group Winding
Slots = 72; Poles = 4; y = 13, 15, 17; q = 6



Trzy obwody równoległe

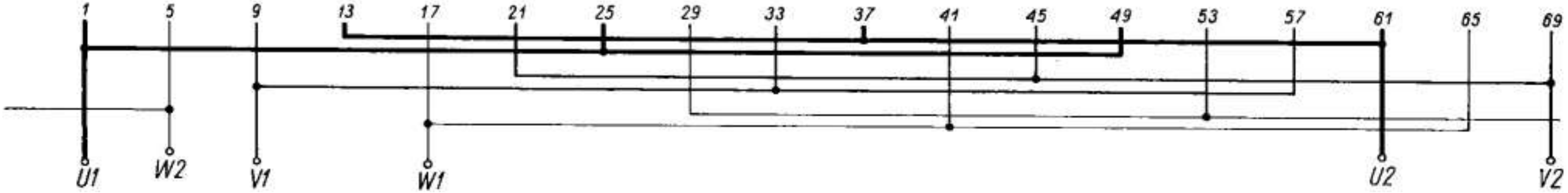
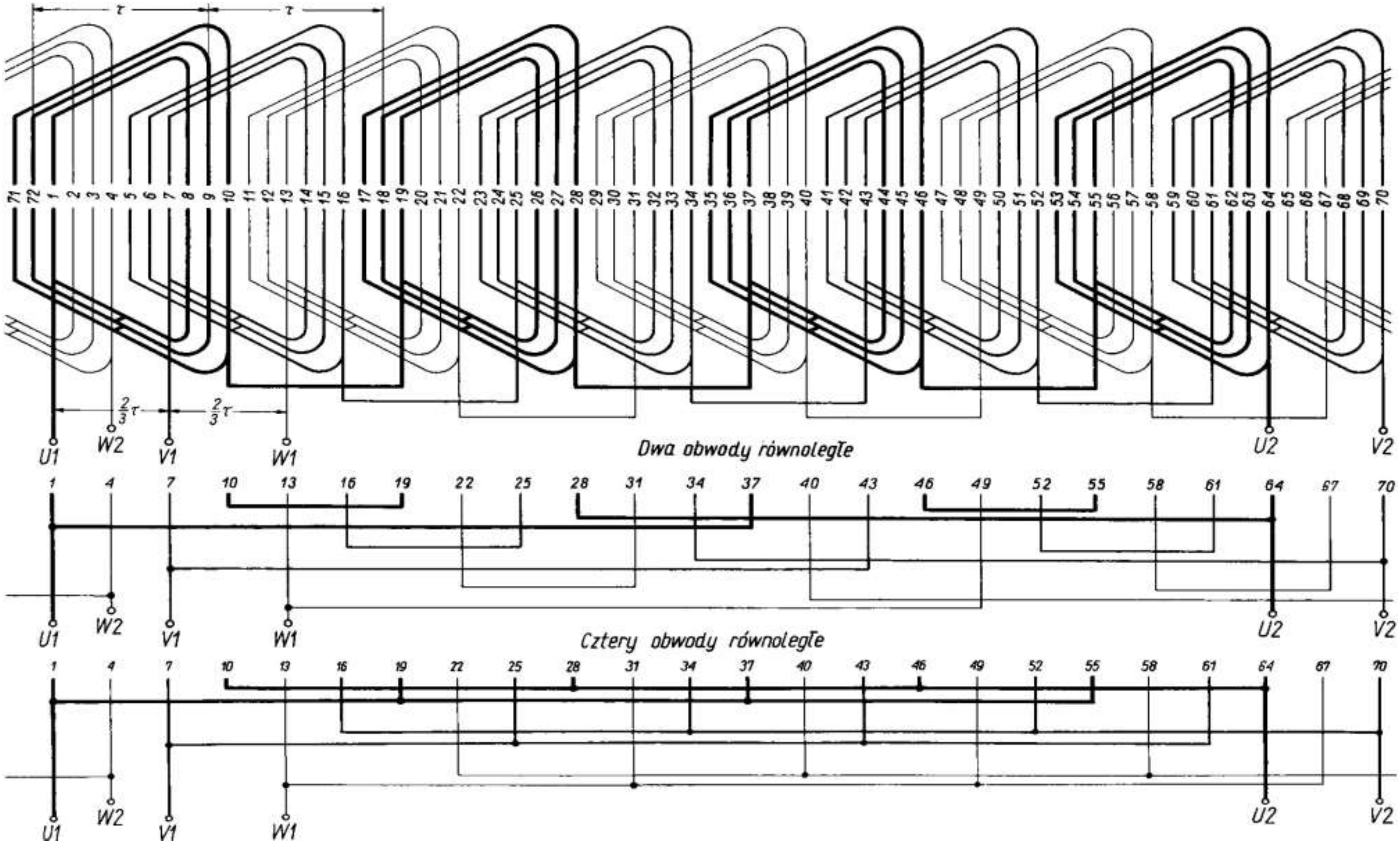


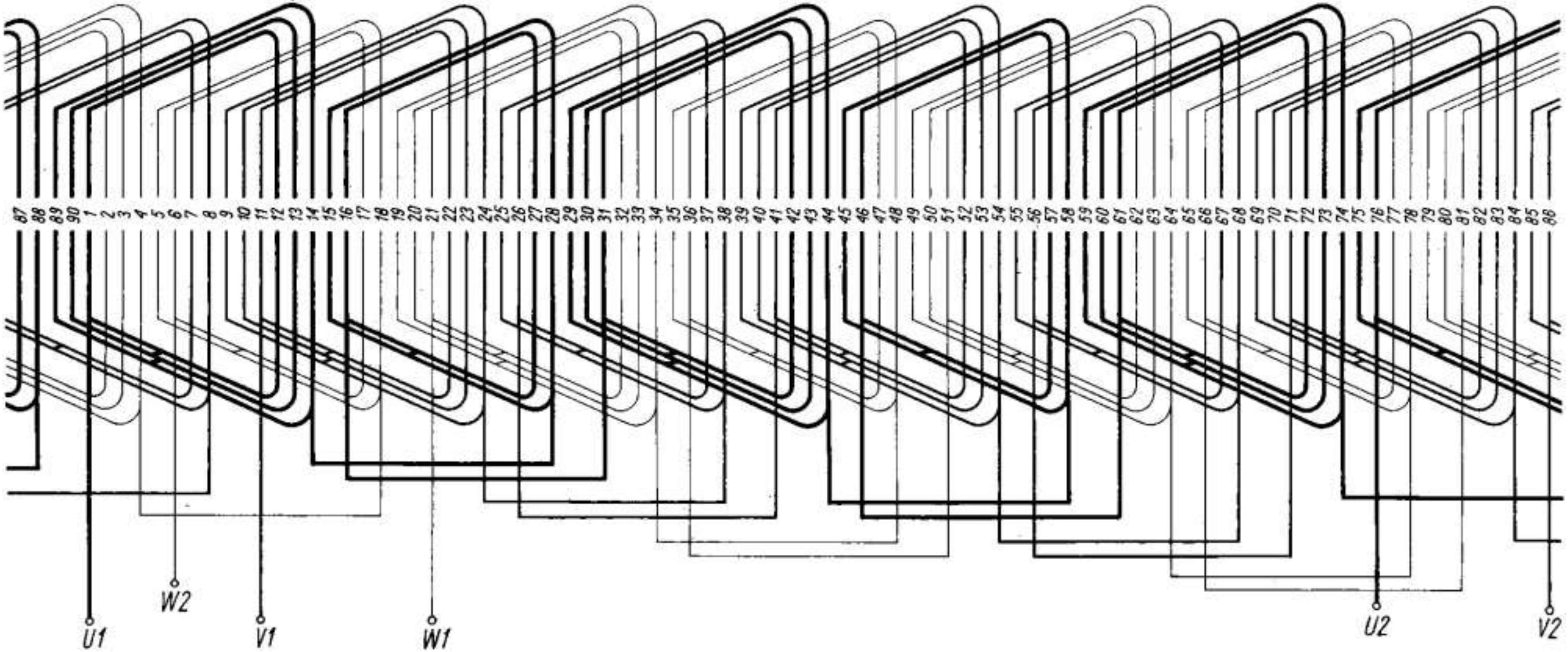
Figure. 57. Concentric Chain Group Winding
Slots = 72; Poles = 6; y = 9, 11, 13, 15; q = 4



Dwa obwody równoległe

Cztery obwody równoległe

Figure. 58. Concentric Chain Group Winding
Slots = 72; Poles = 8; y = 7, 9, 11; q = 3



Trzy obwody równoległe

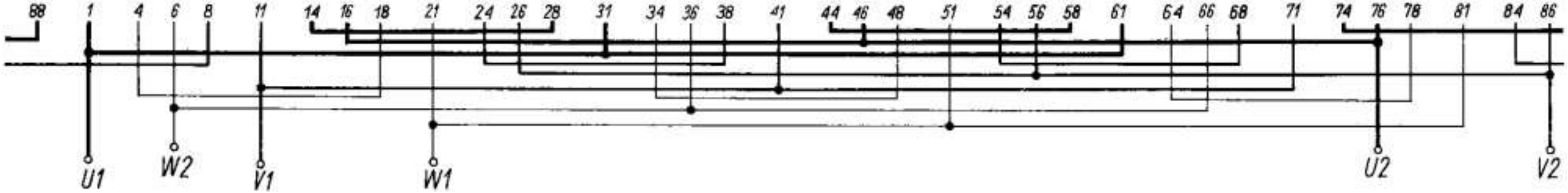


Figure. 59. Concentric Chain Group Winding with odd groups
Slots = 90; Poles = 6; y = 11, 13, 15; q = 5

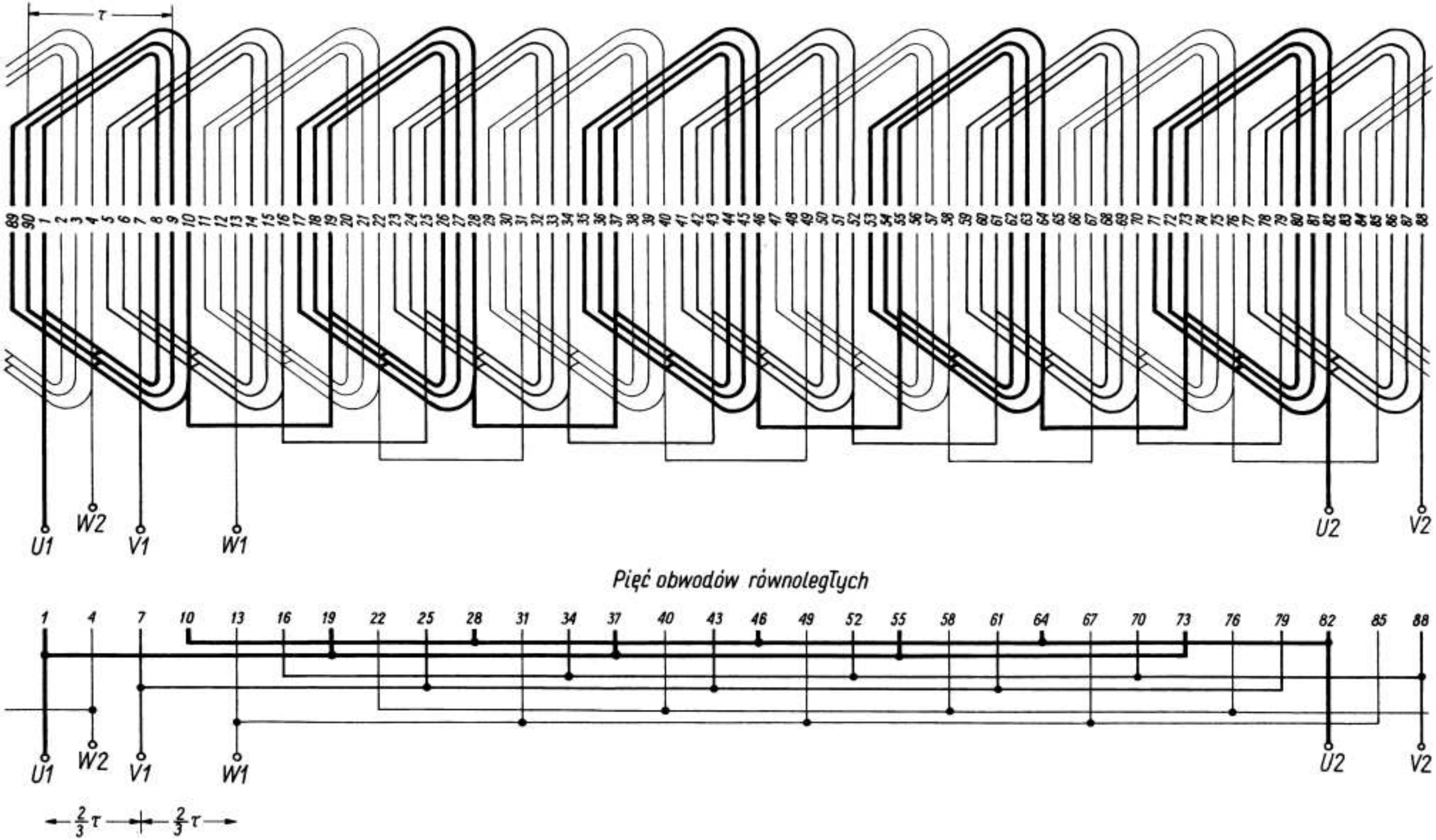
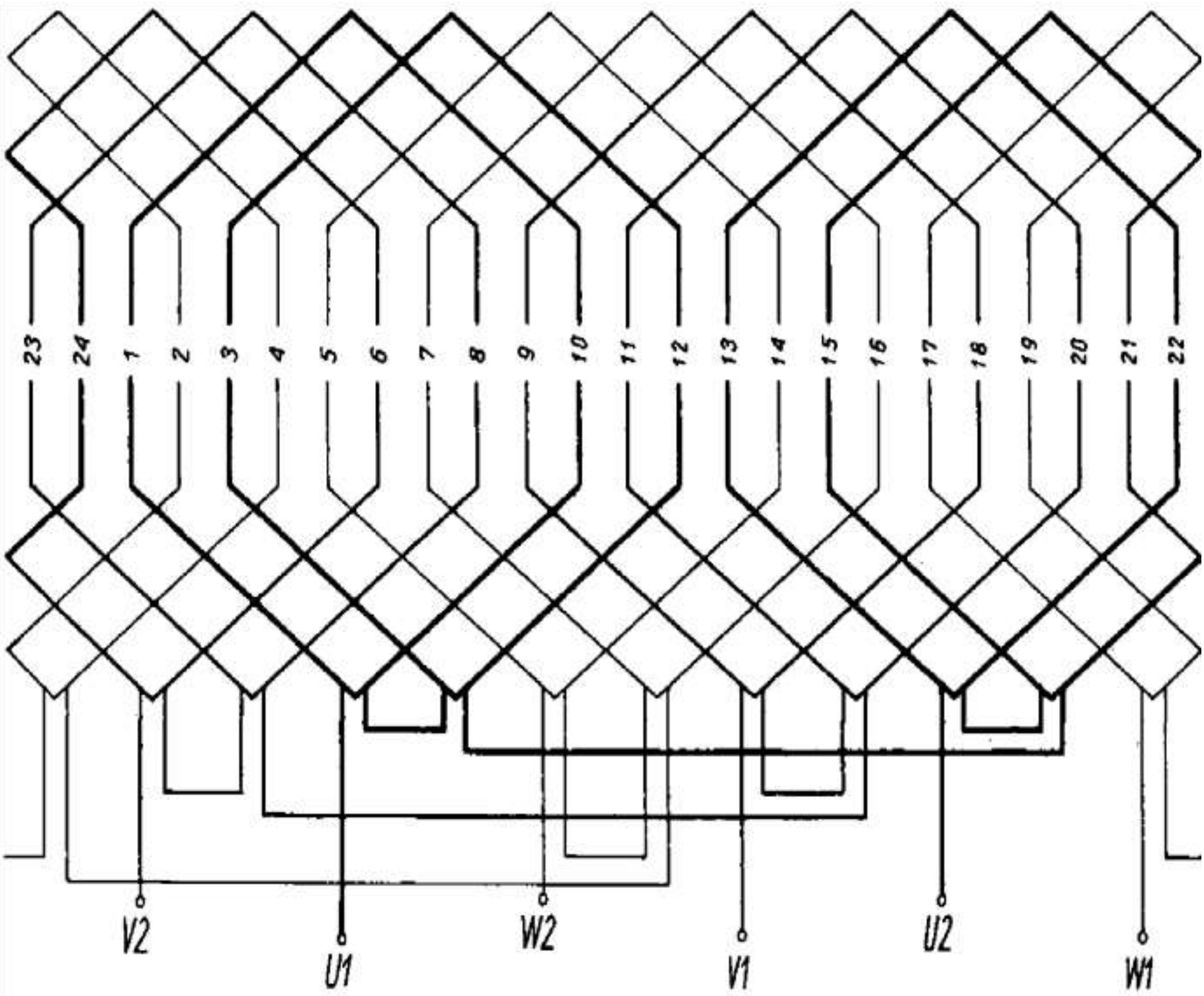


Figure. 60. Concentric Chain Group Winding
Slots = 90; Poles = 10; y = 7, 9, 11; q = 3

Basket Windings



Dwa obwody równoległe

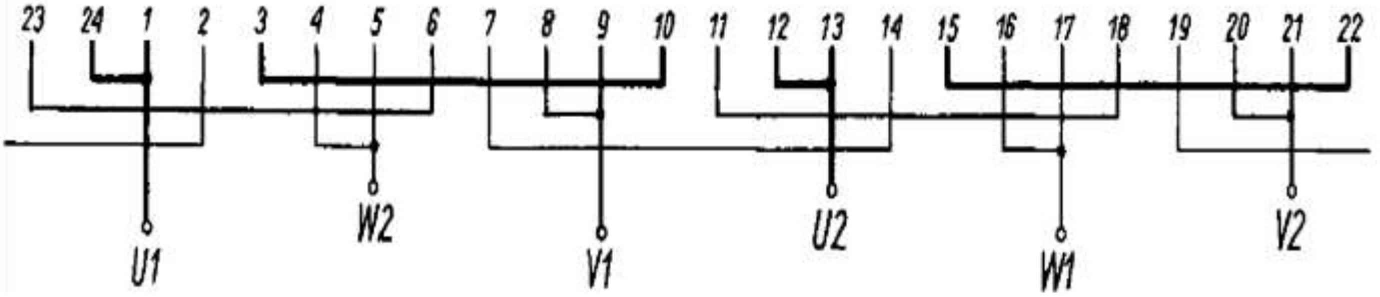


Figure. 61. Basket Winding
Slots = 24; Poles = 2; y = 9; q = 4

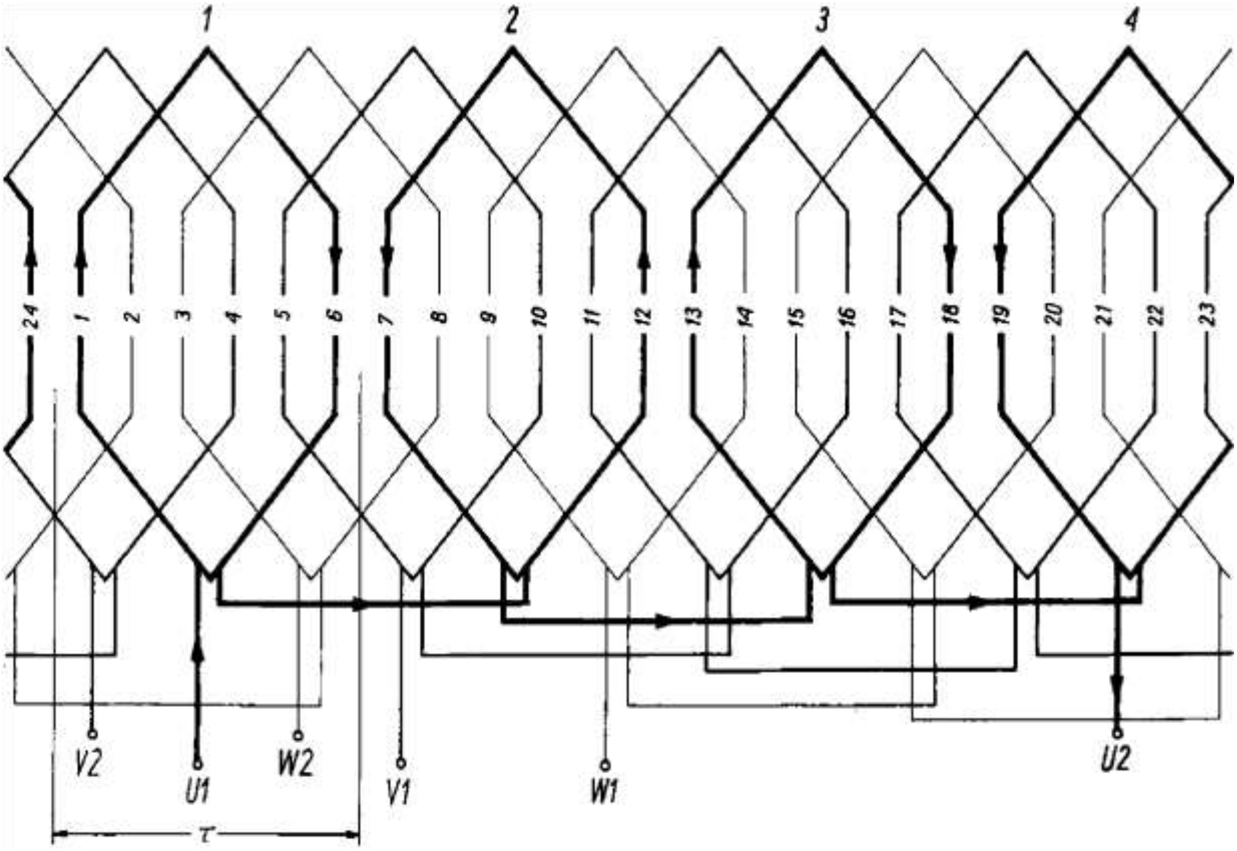


Figure. 62. Basket Winding
Slots = 24; Poles = 4; y = 5; q = 2

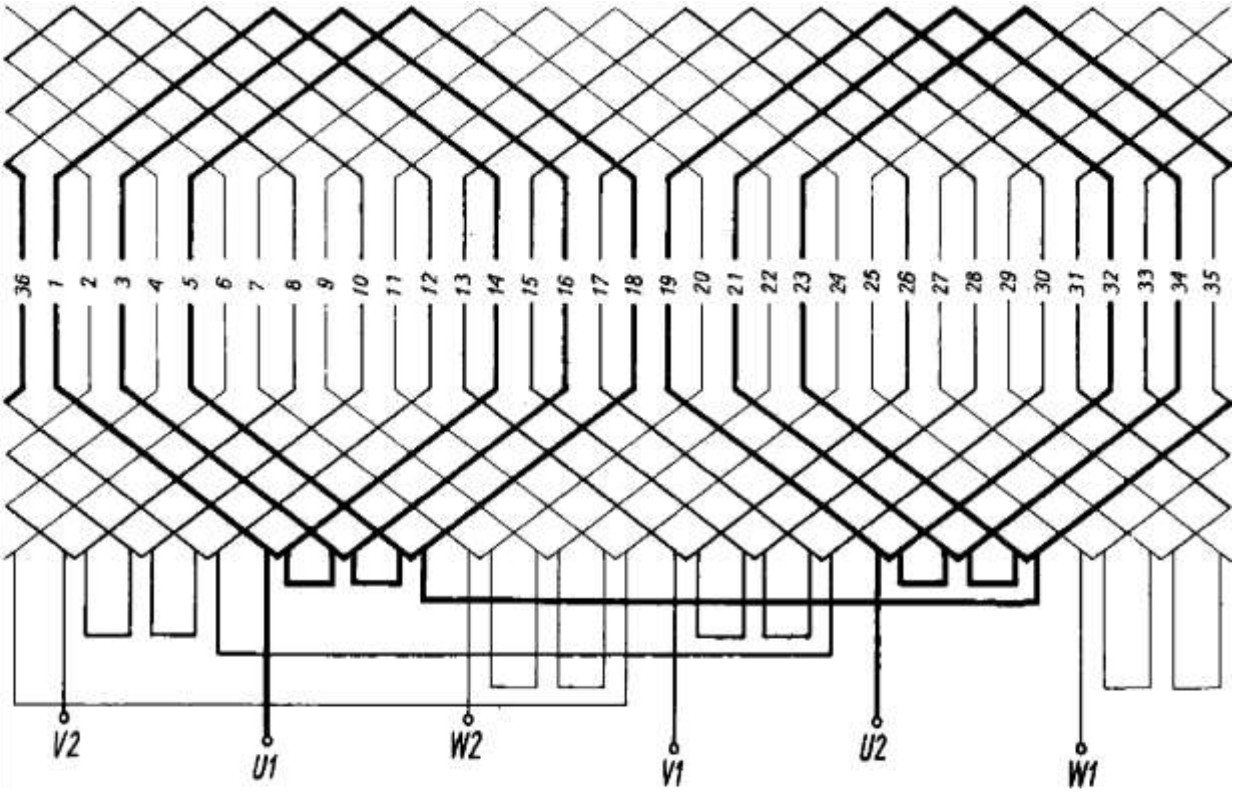


Figure. 63. Basket Winding
Slots = 36; Poles = 2; y = 13; q = 6

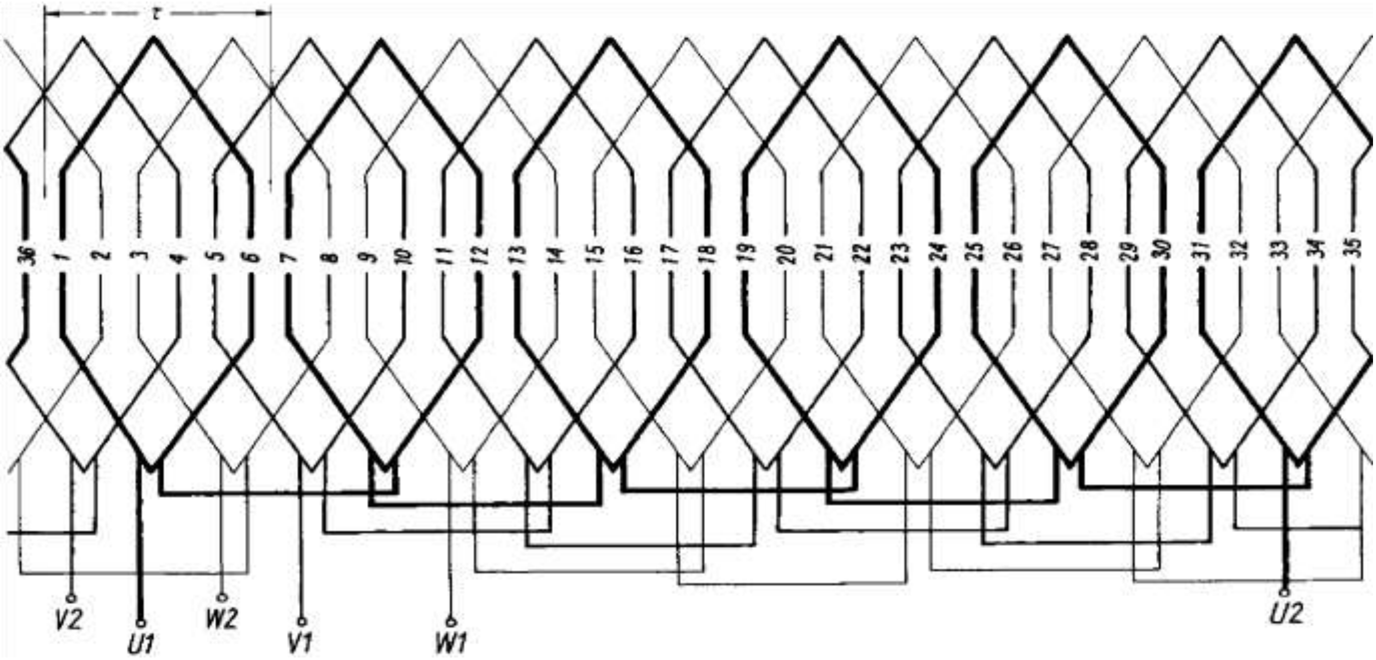


Figure. 64. Basket winding
Slots = 36; Poles = 6; y = 5; q = 2

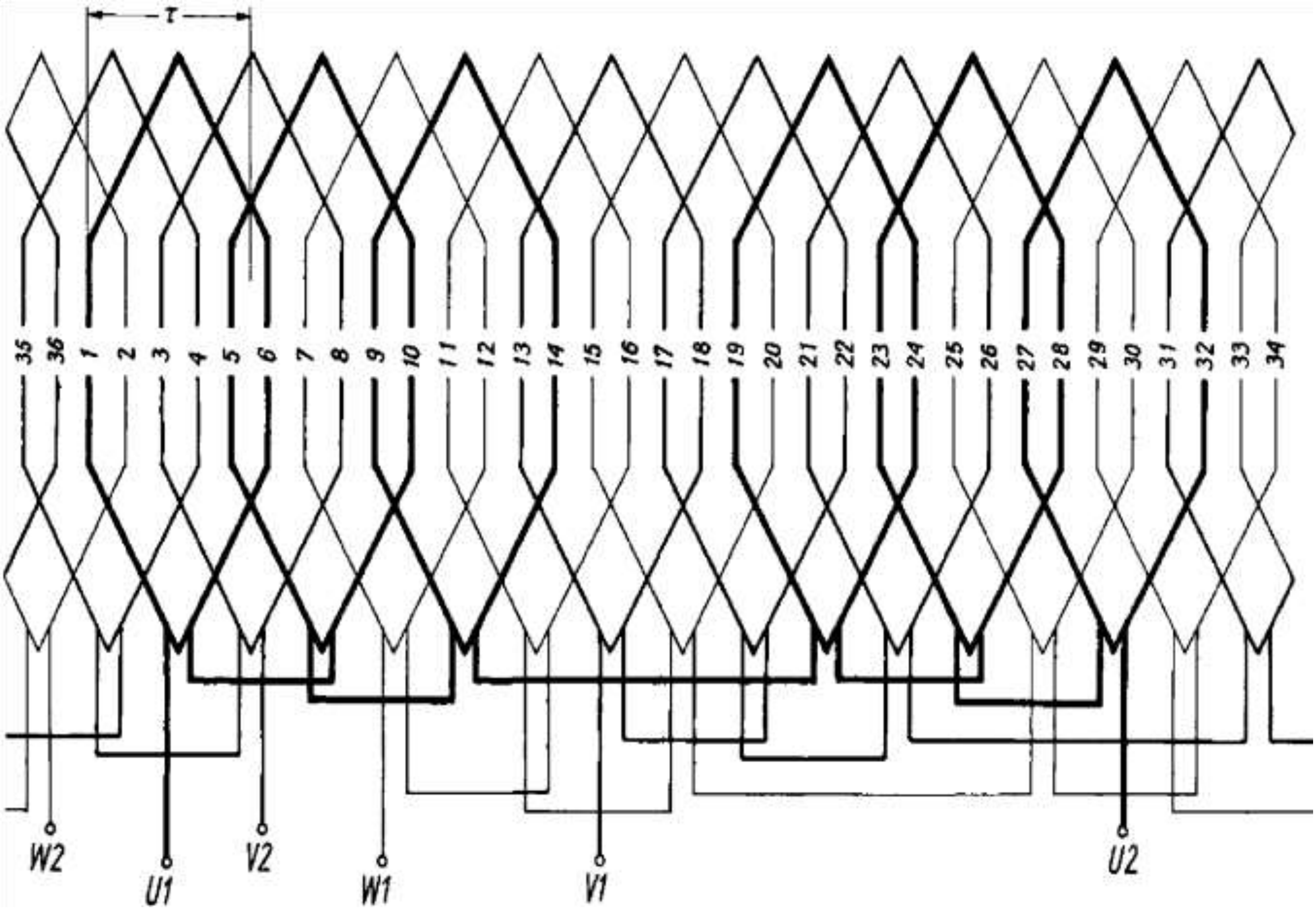


Figure. 64a. Basket Winding
Slots = 36; Poles = 8; y = 5; q = 1 $^1/_2$

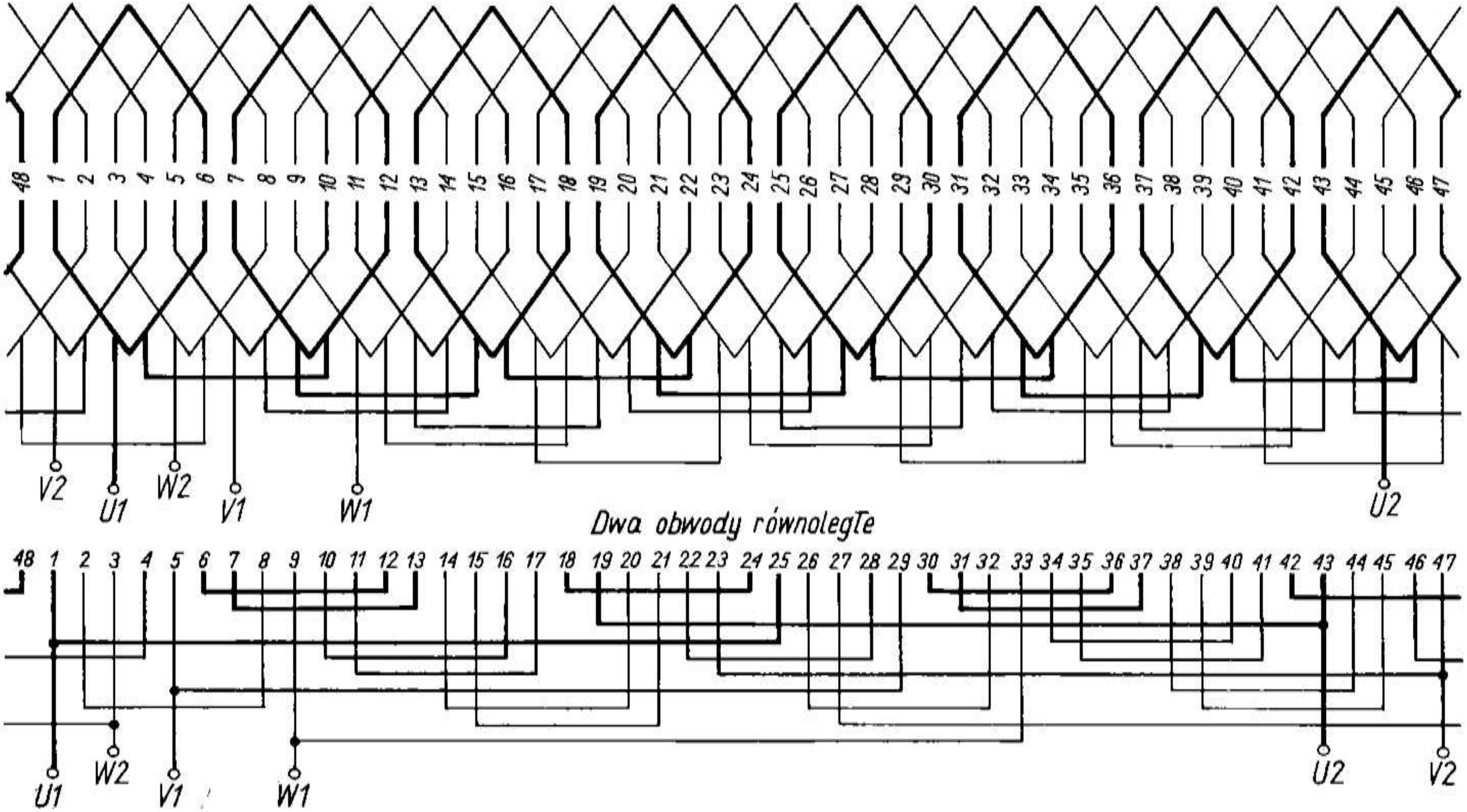


Figure. 65. Basket Winding
Slots = 48; Poles = 8; y = 5; q = 2

Double-layer Winding

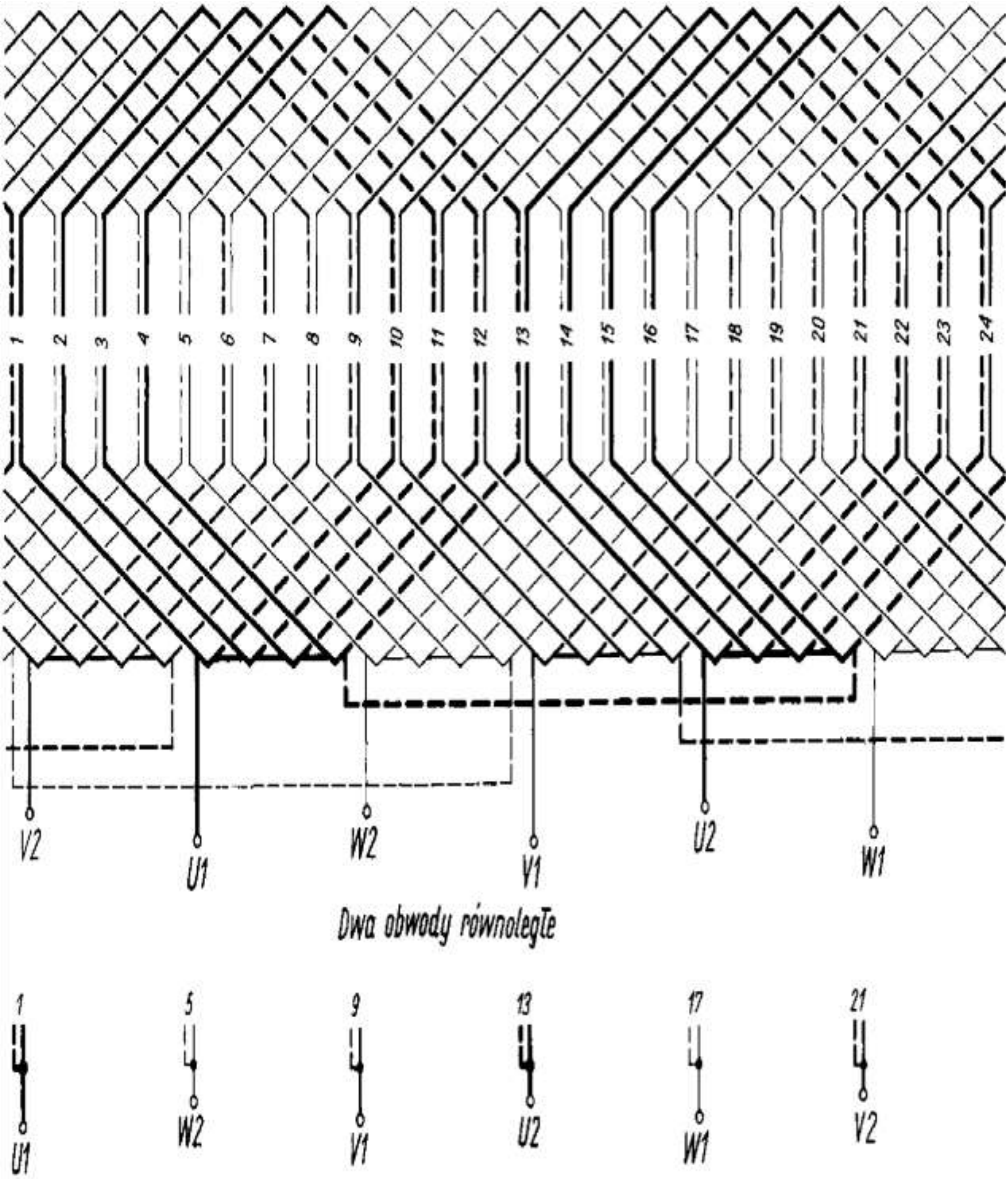
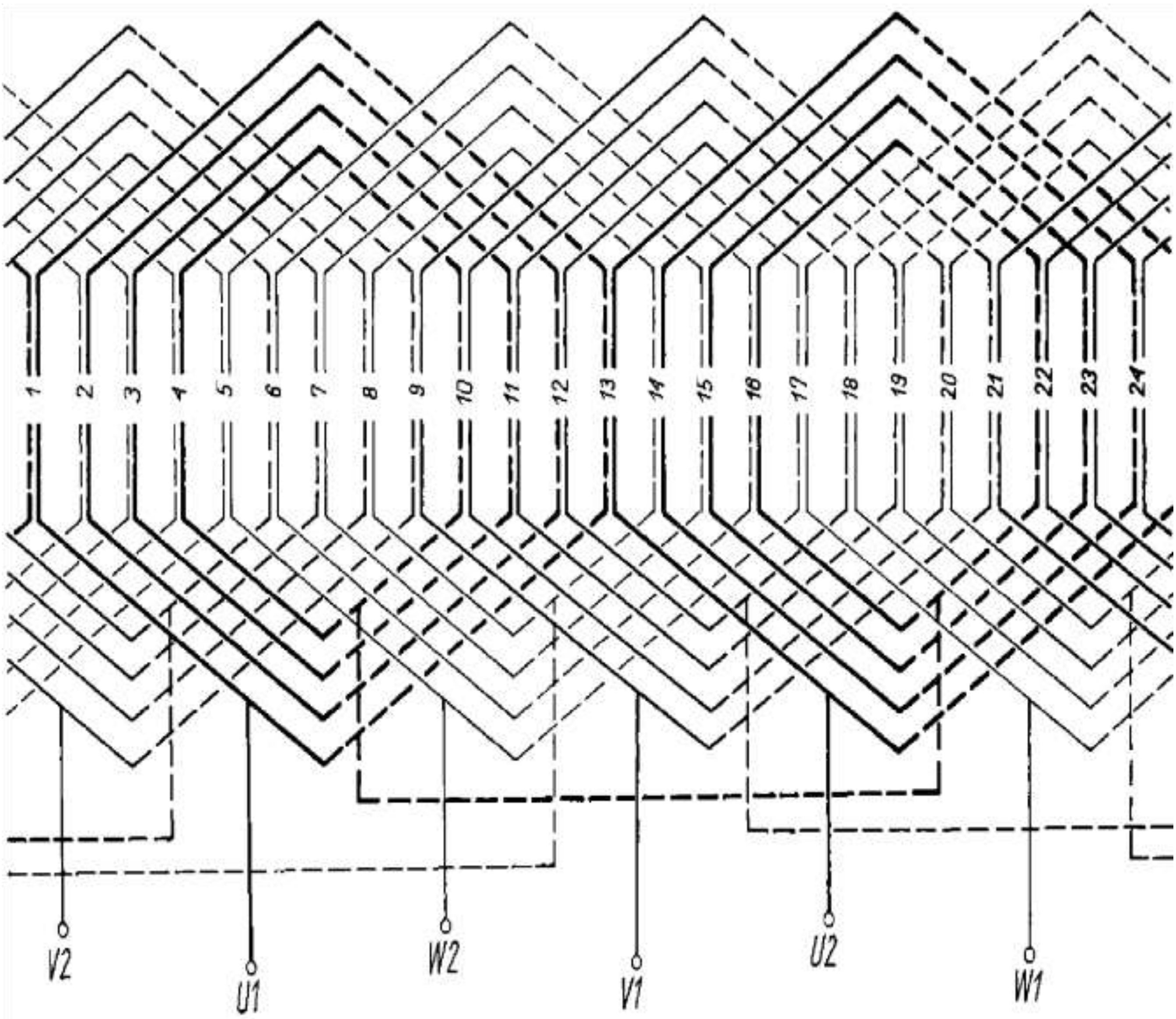


Figure. 66. Double-layer lap Winding
Slots = 24; Poles = 2; y = 9; q = 4



Dwa obwody równoległe

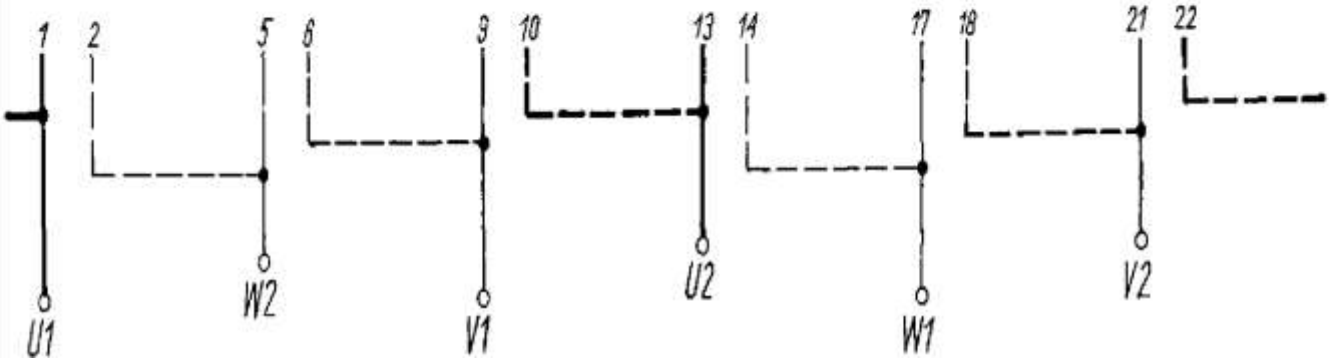
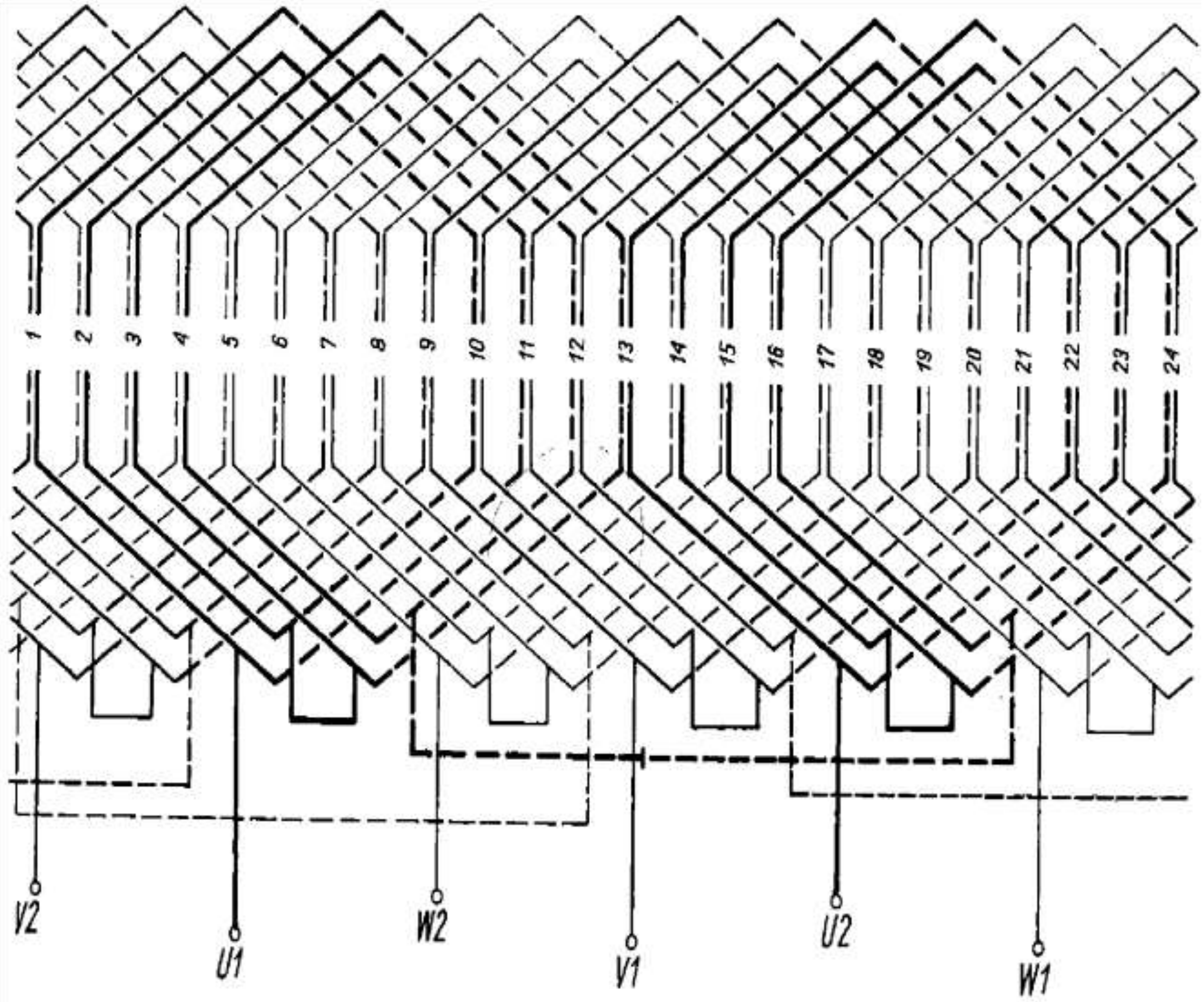


Figure. 66a. Double-layer concentric winding
Slots = 24; Poles = 2; y = 6, 8, 10, 12; q = 4



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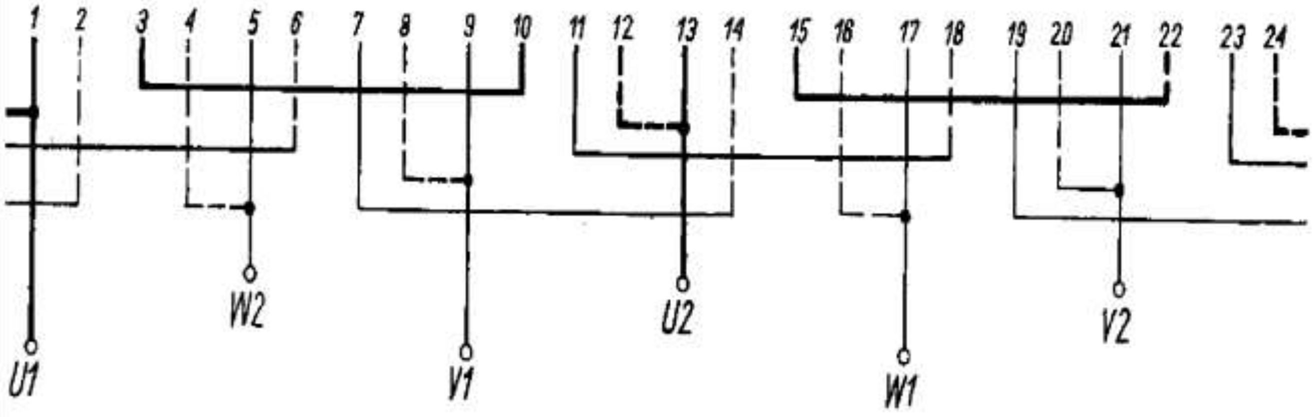
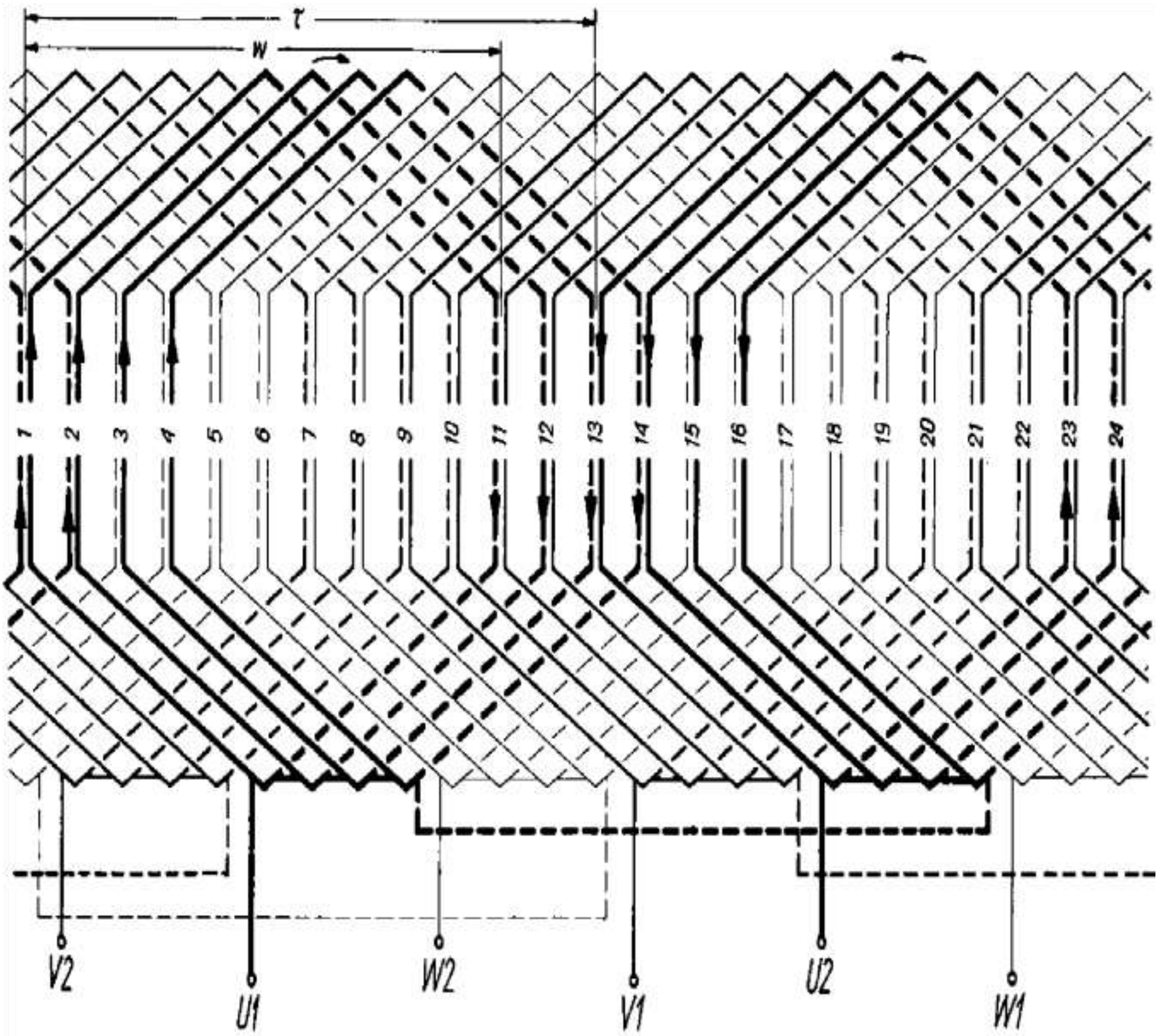


Figure. 66b. Concentric Double - Layer Winding with split groups
Slots = 24; Poles = 2; y = 8, 10; q = 4



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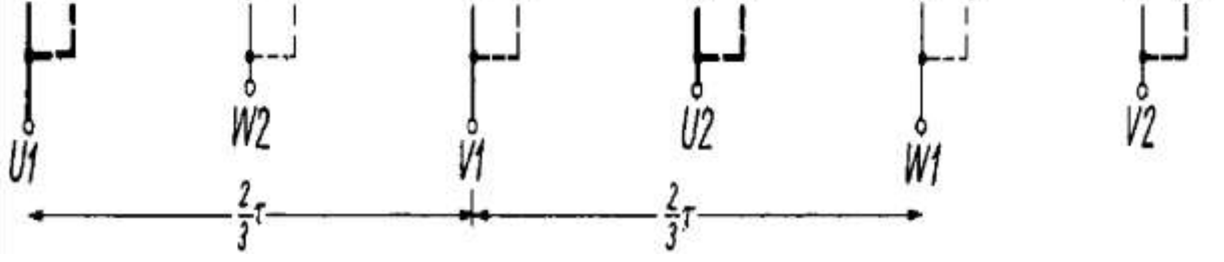
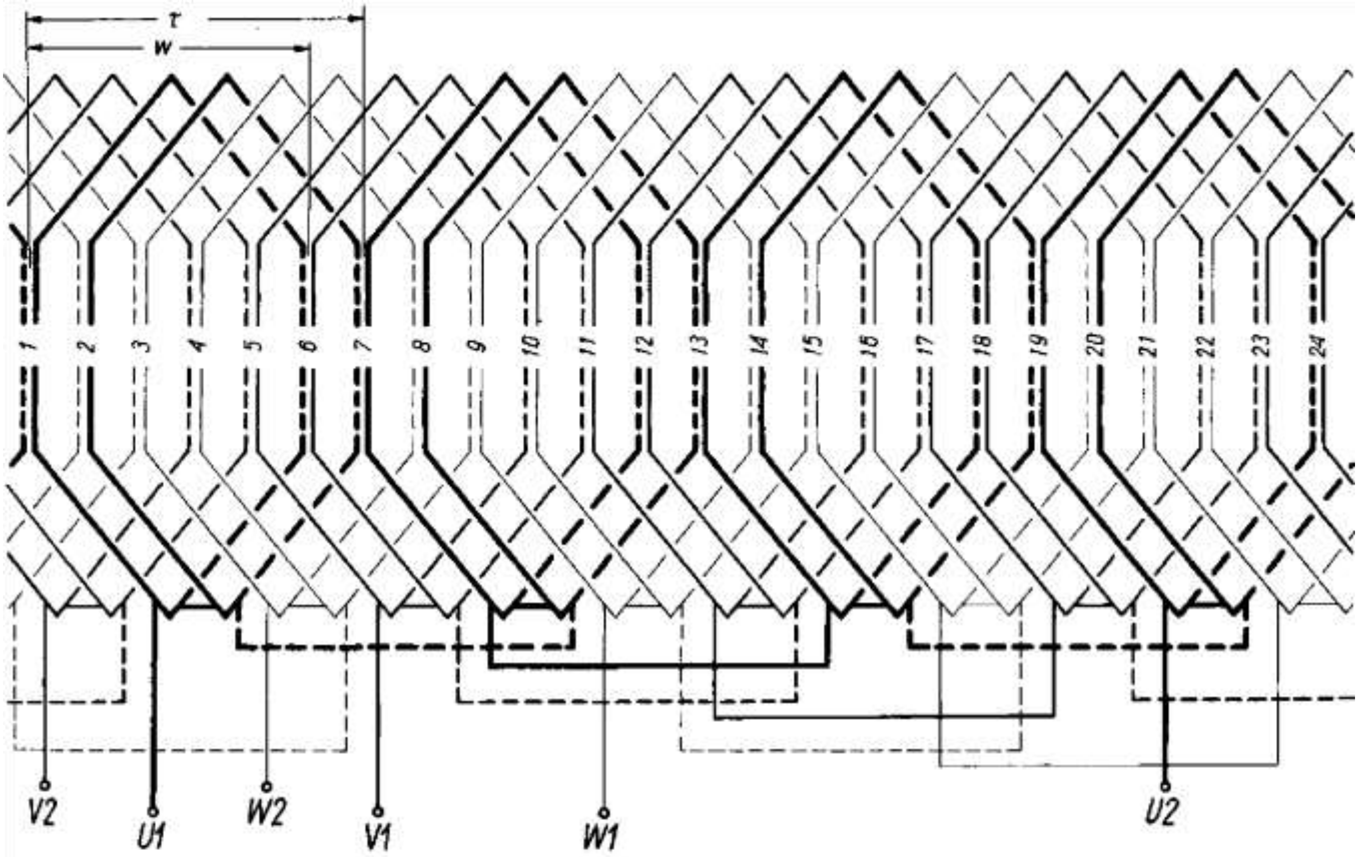


Figure. 67. Double-layer lap Winding
Slots = 24; Poles = 2; y = 10; q = 4



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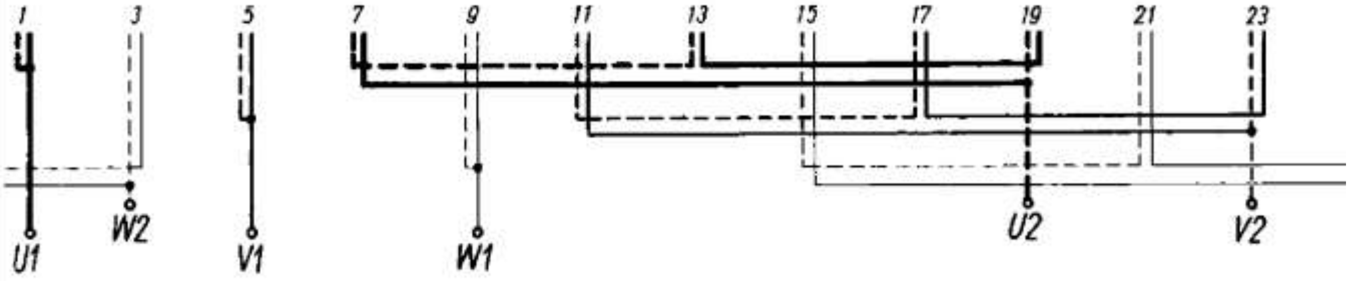

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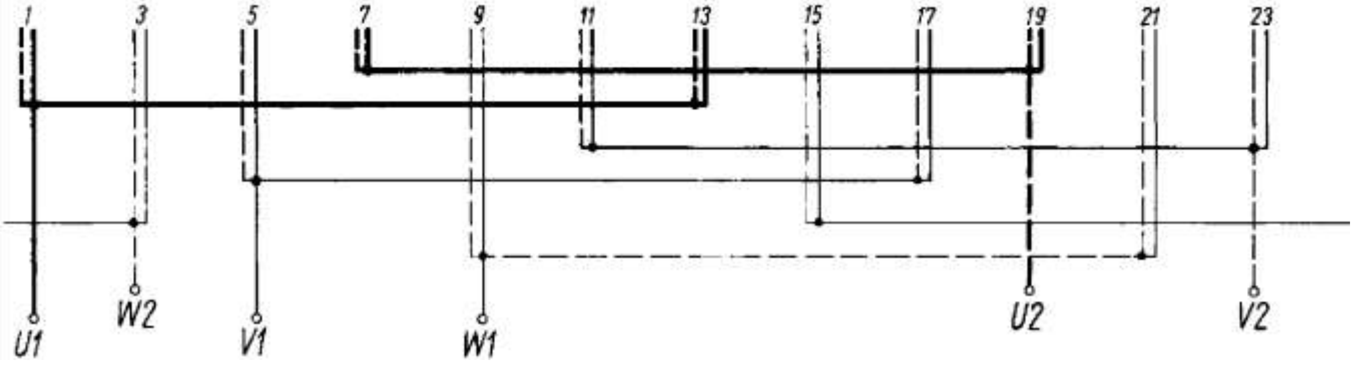
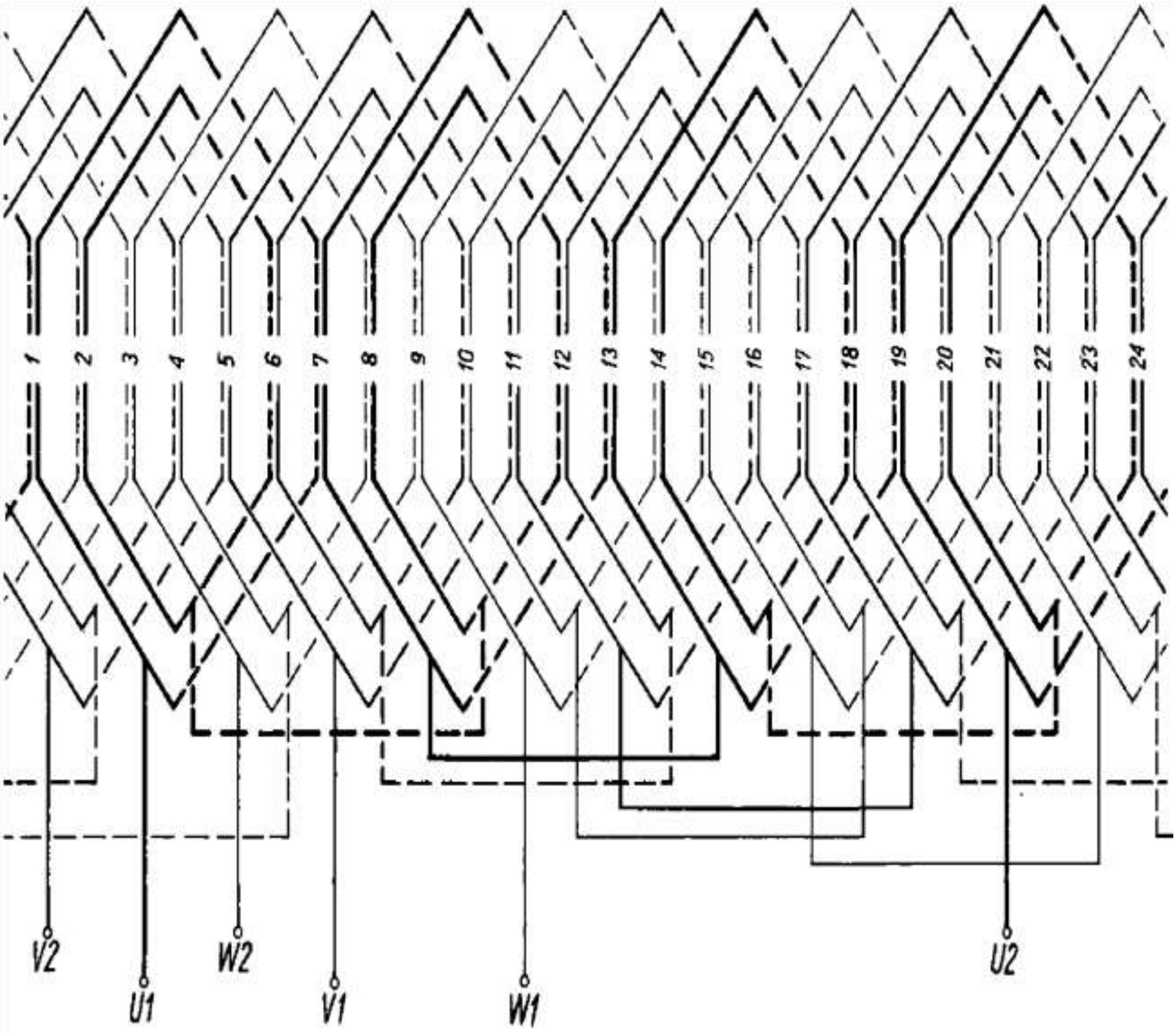


Figure. 68. Double-layer lap Winding
Slots = 24; Poles = 4; y = 5; q = 2



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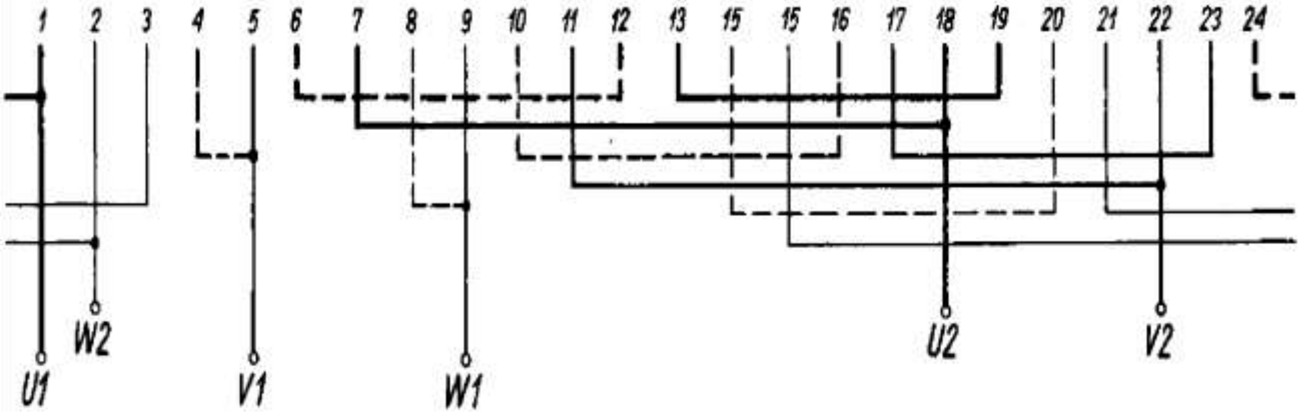


Figure. 68a. Double - layer concentric Winding
Slots = 24; Poles = 4; y = 4, 6; q = 2

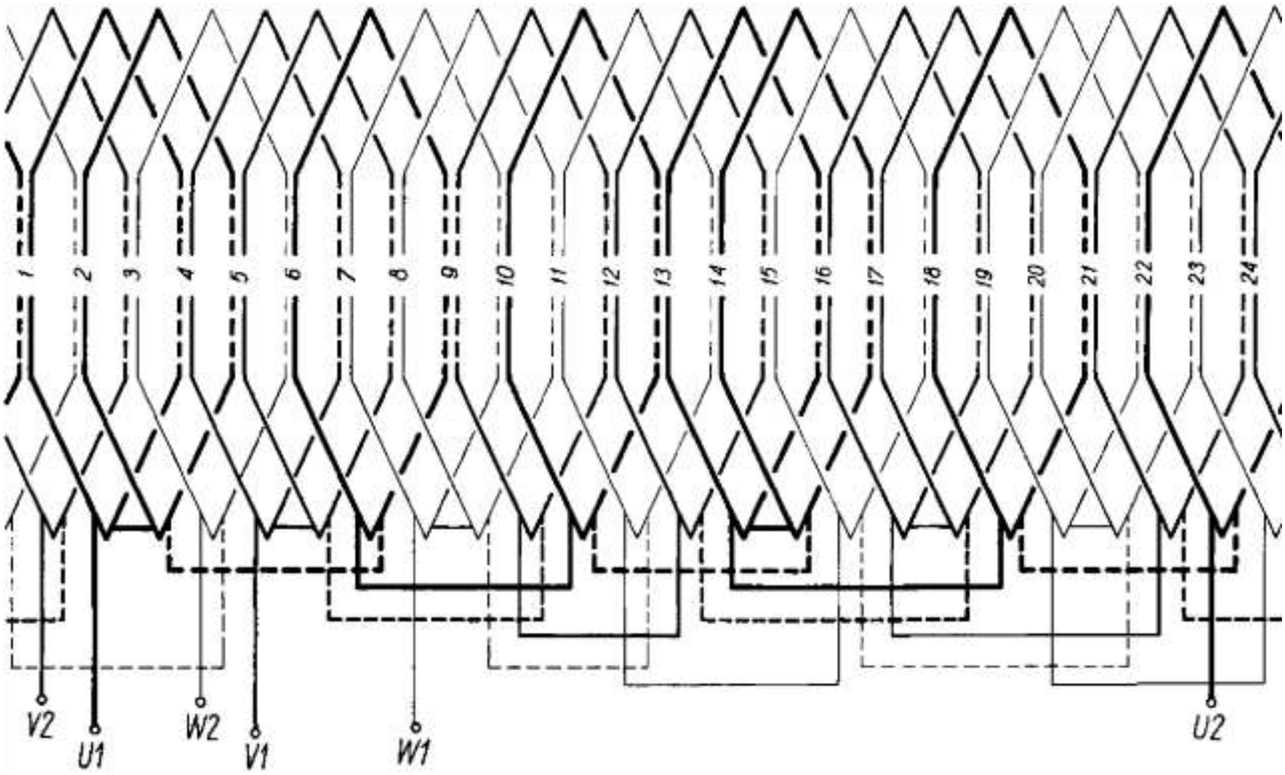


Figure. 69. Double-layer lap Winding odd groups (asymmetrical, rarely used)
Slots = 24; Poles = 6; y = 3; q = 1 ½

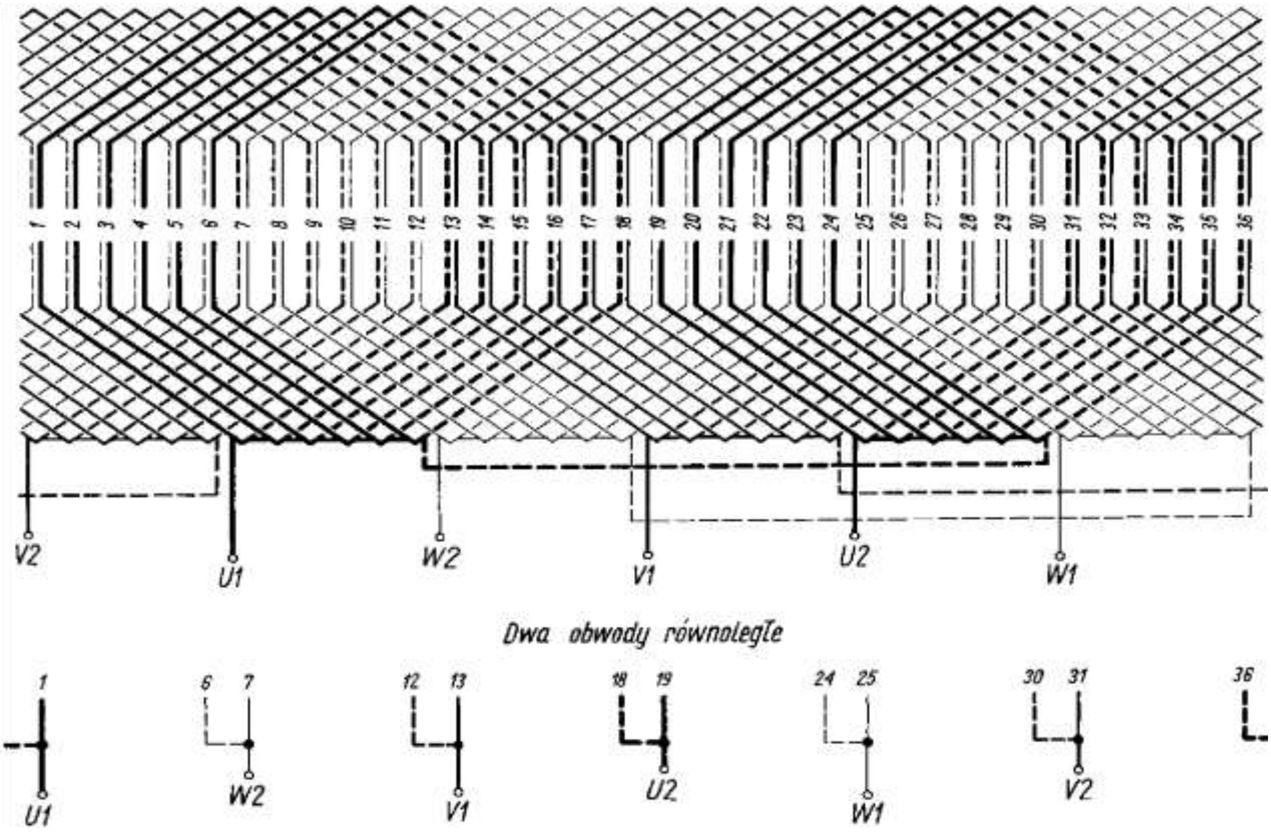
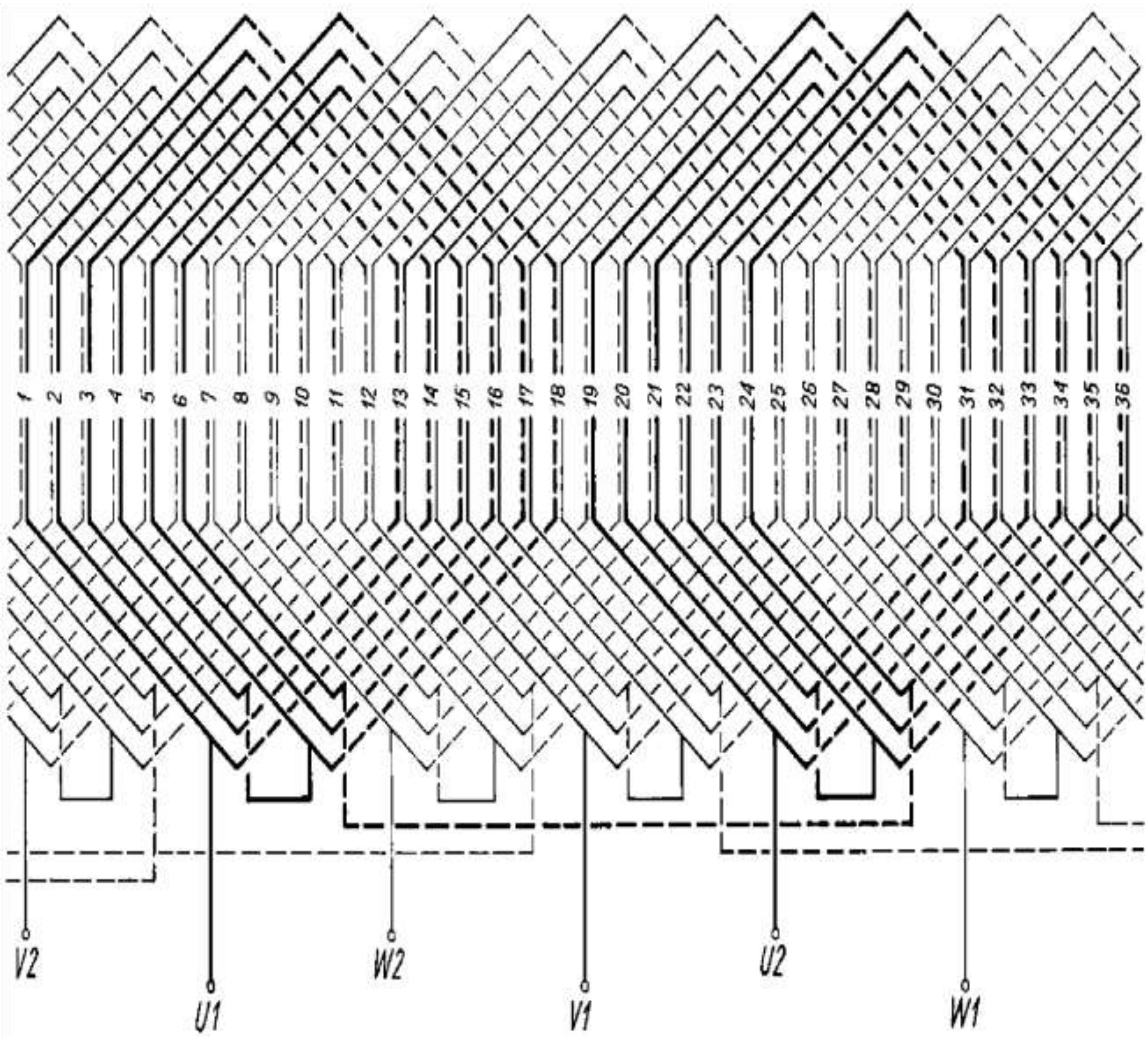


Figure. 70. Double-layer lap Winding
Slots = 36; Poles = 2; y = 12; q = 6



Dwa obwody równoległe

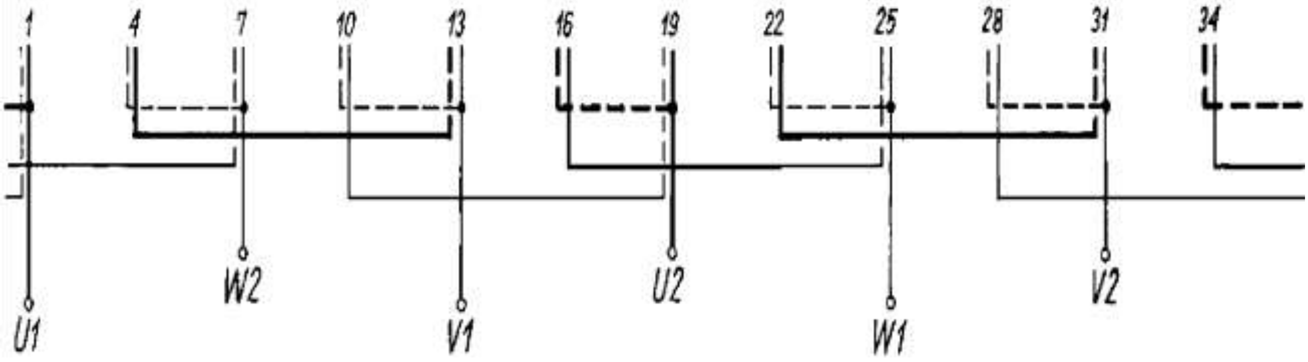
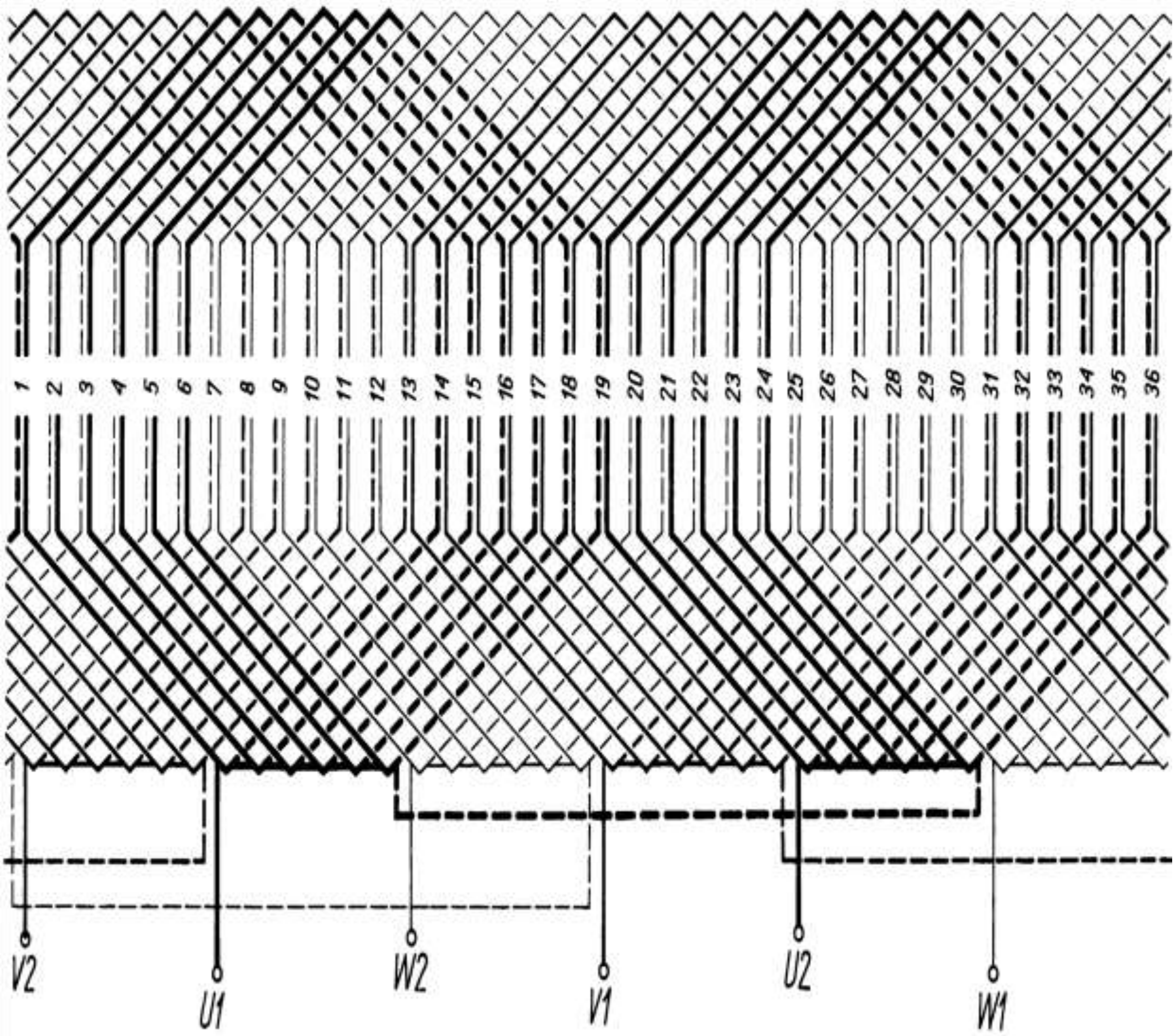


Figure. 70a. Concentric Double - Layer Winding (Split Groups)
Slots = 36; Poles = 2; y = 10, 12, 14; q = 6



Dwa obwody równoległe

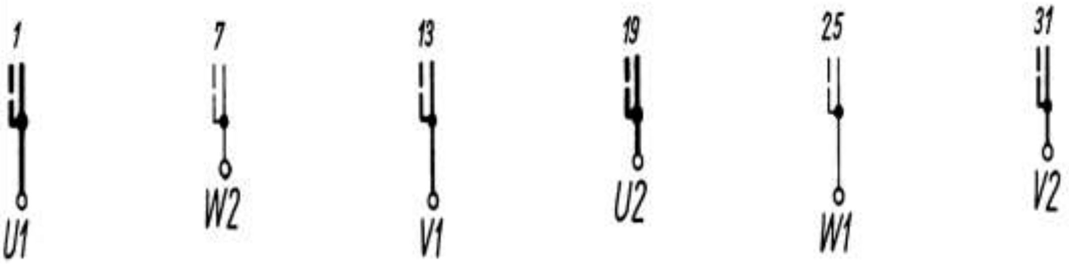
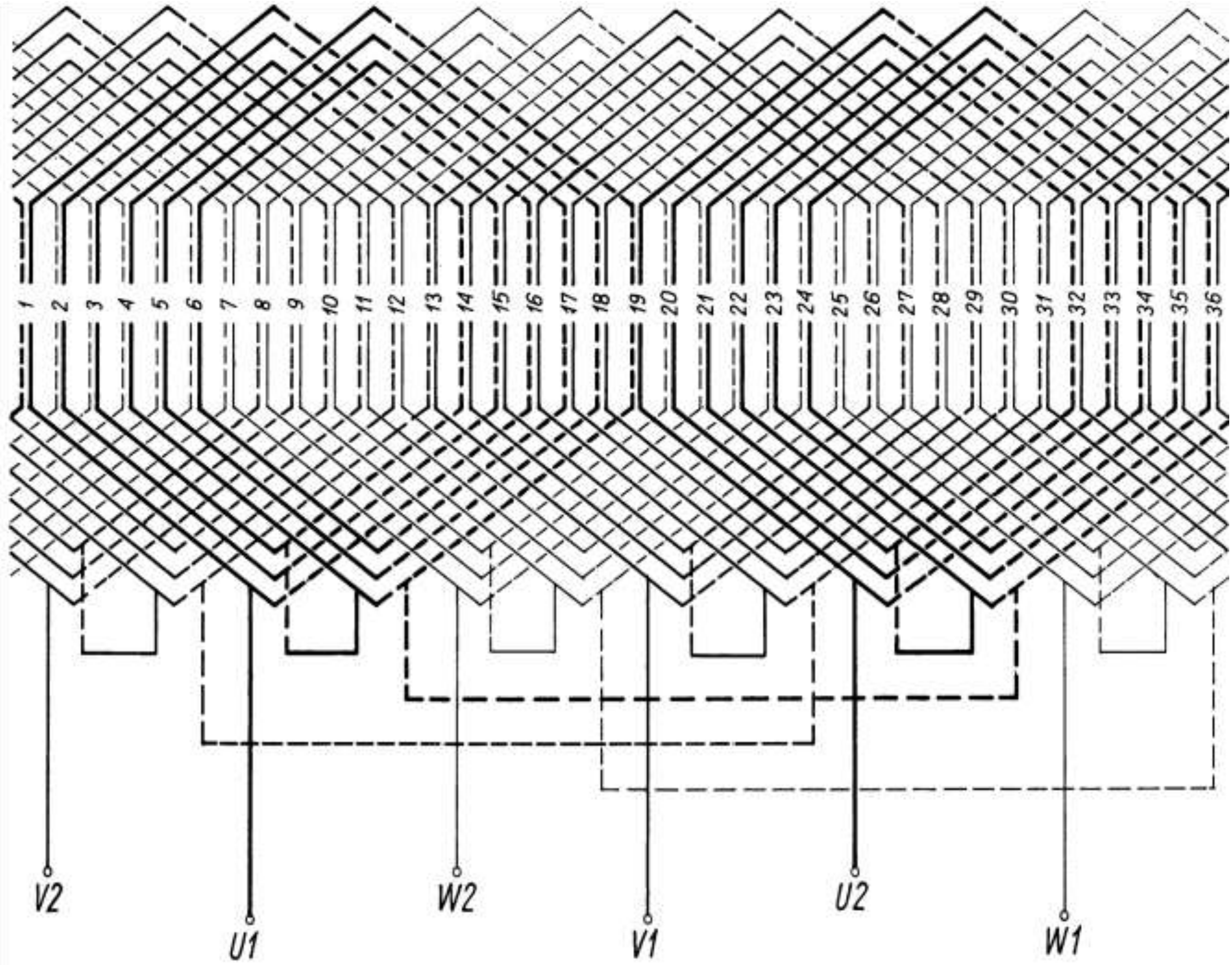


Figure. 71. Double-layer lap Winding
Slots = 36; Poles = 2; y = 13; q = 6



Dwa obwody równoległe

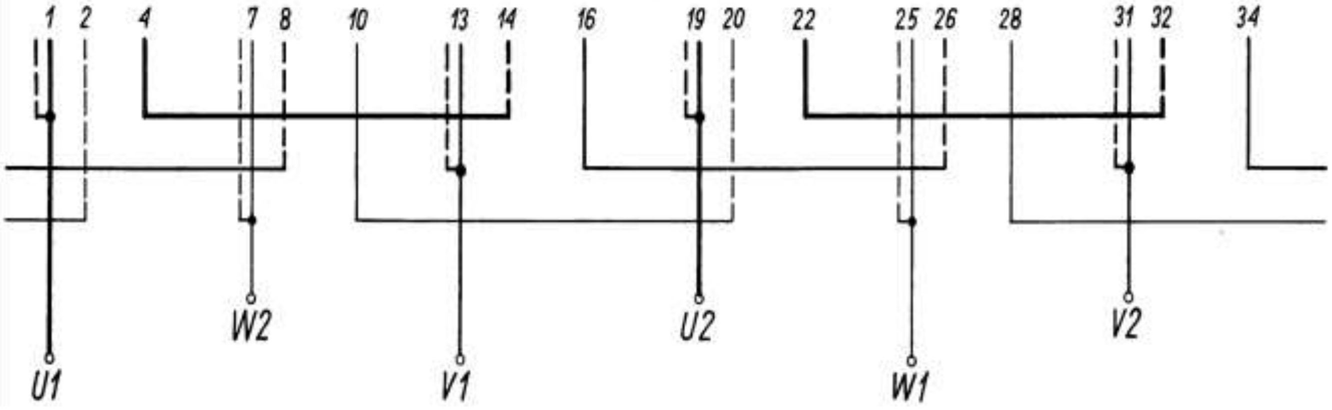


Figure. 71a. Double-layer lap Winding
Slots = 36; Poles = 2; y = 11, 13, 15; q = 6

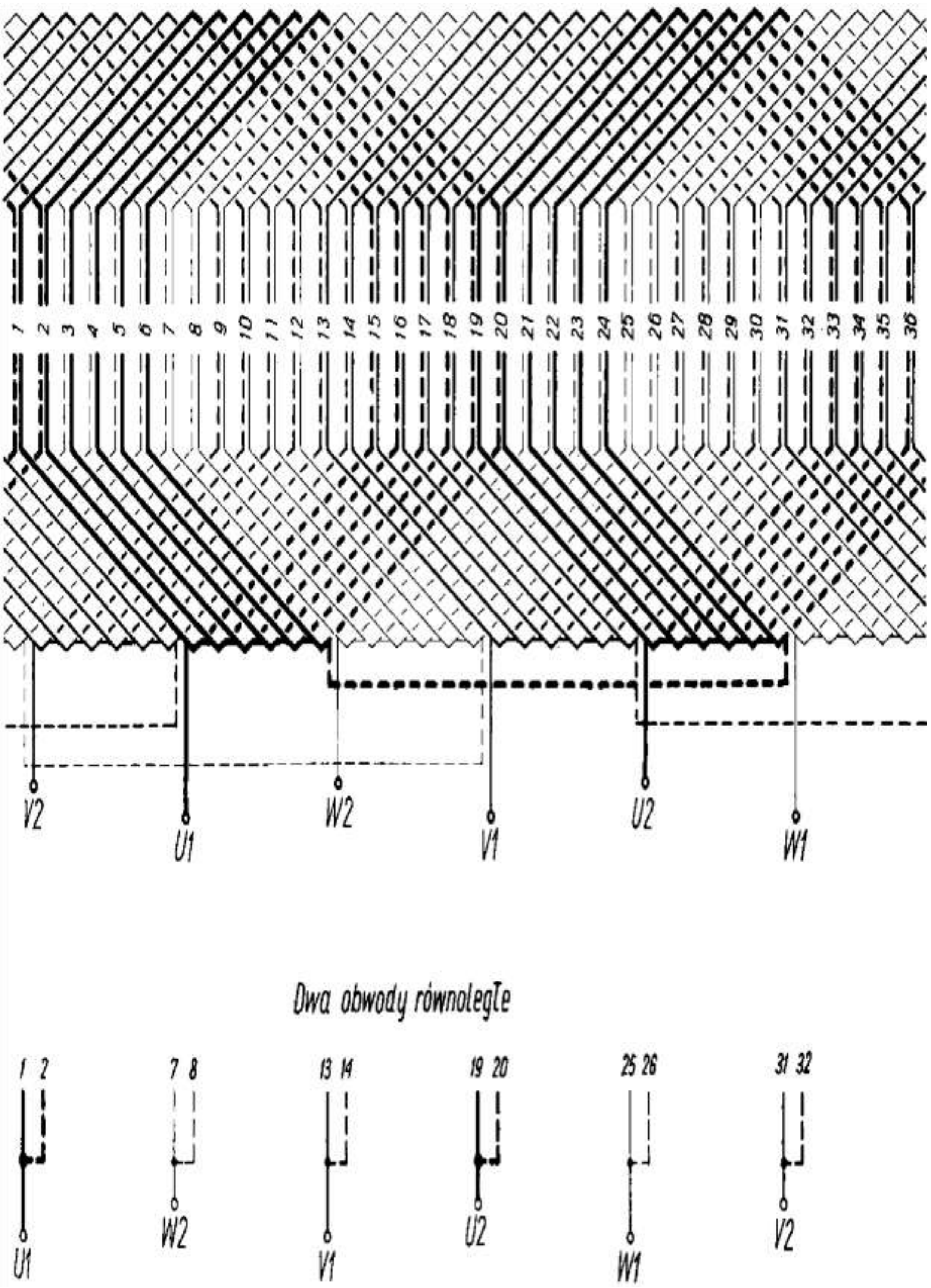
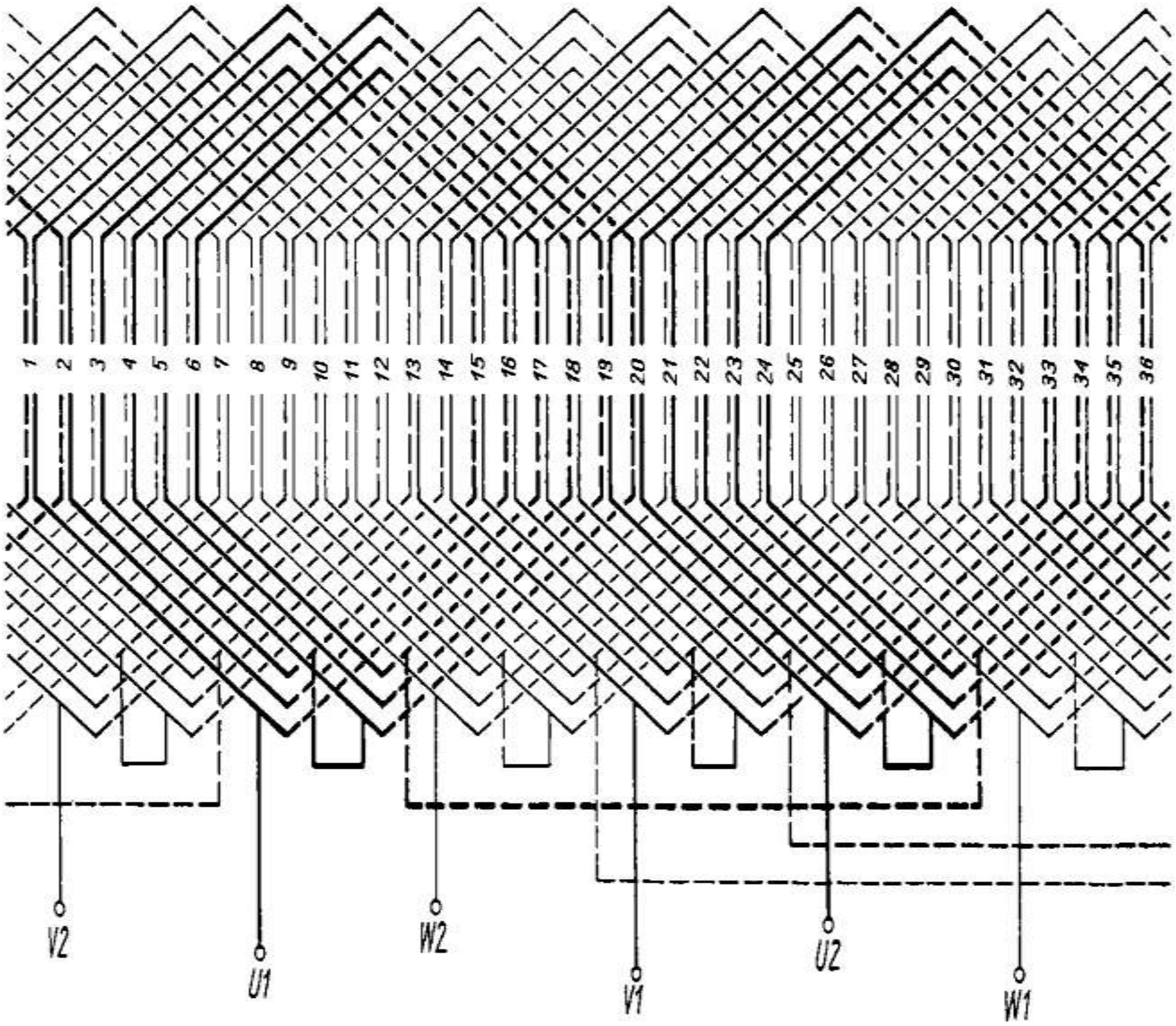


Figure. 72. Double-layer lap Winding
Slots = 36; Poles = 2; y = 14; q = 6



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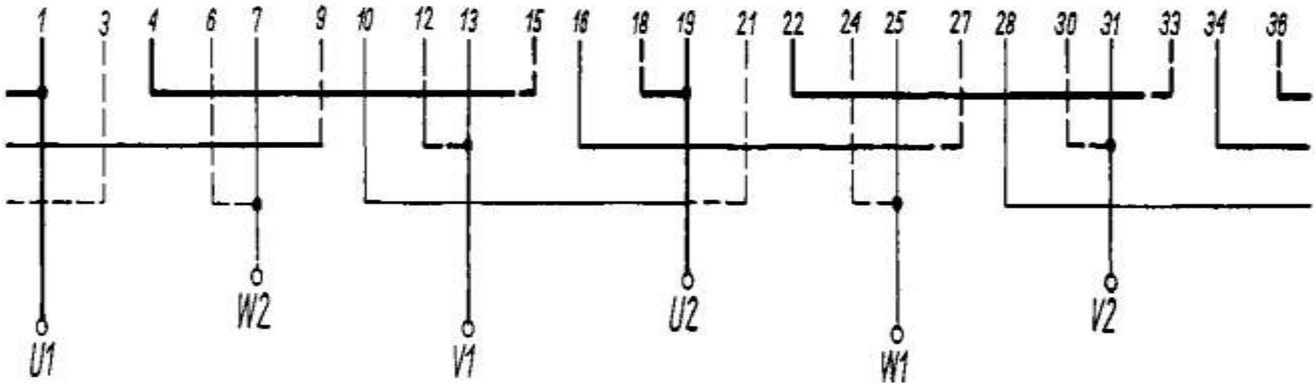
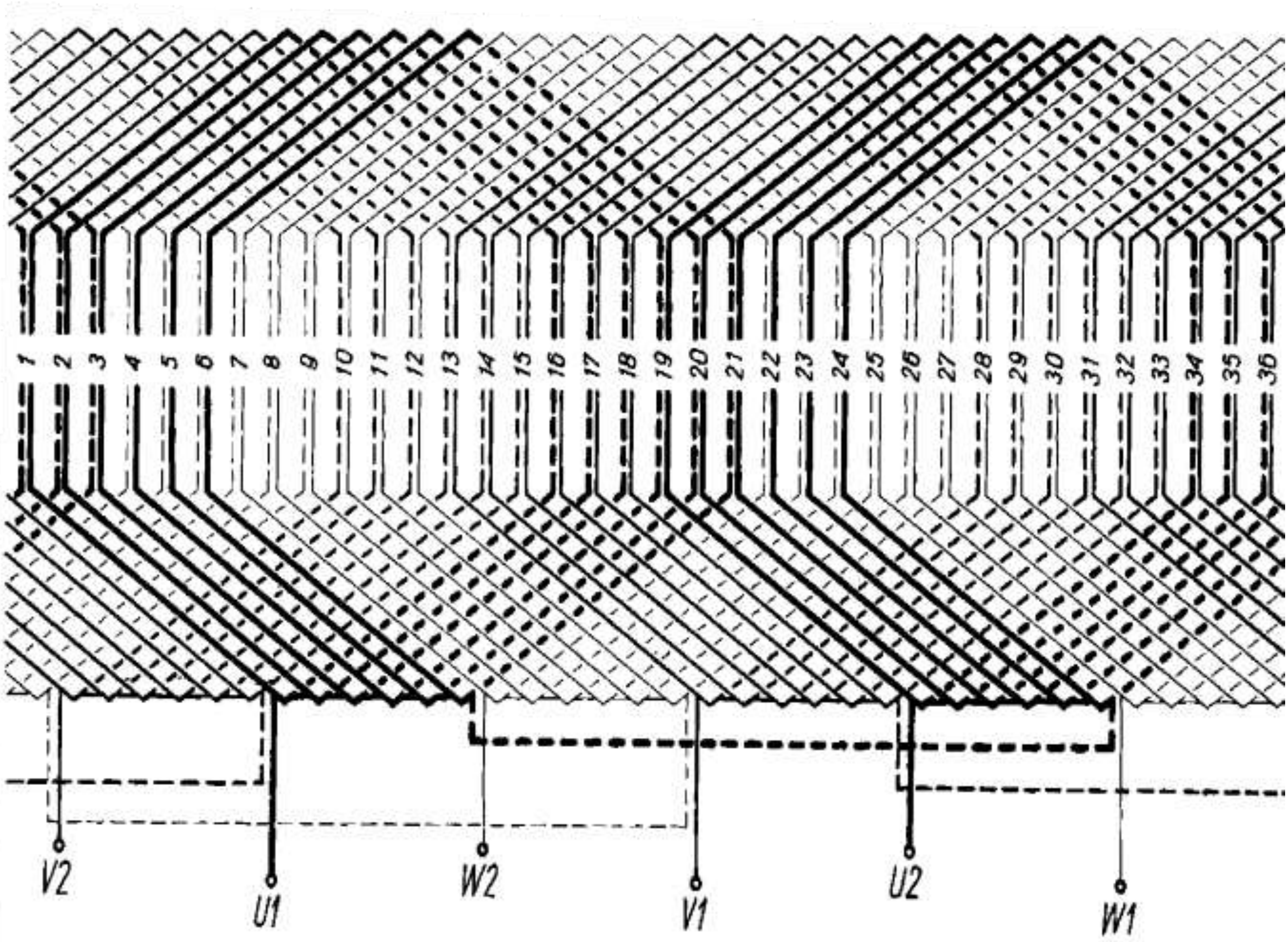


Figure. 72a. Concentric Double - Layer Winding (Split Groups)
Slots = 36; Poles = 2; y = 12, 14, 16; q = 6



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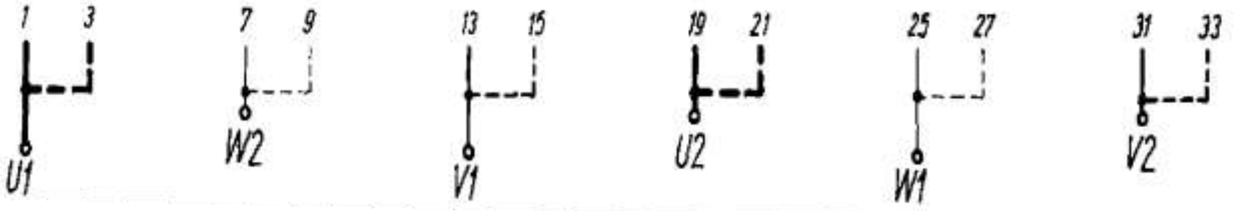
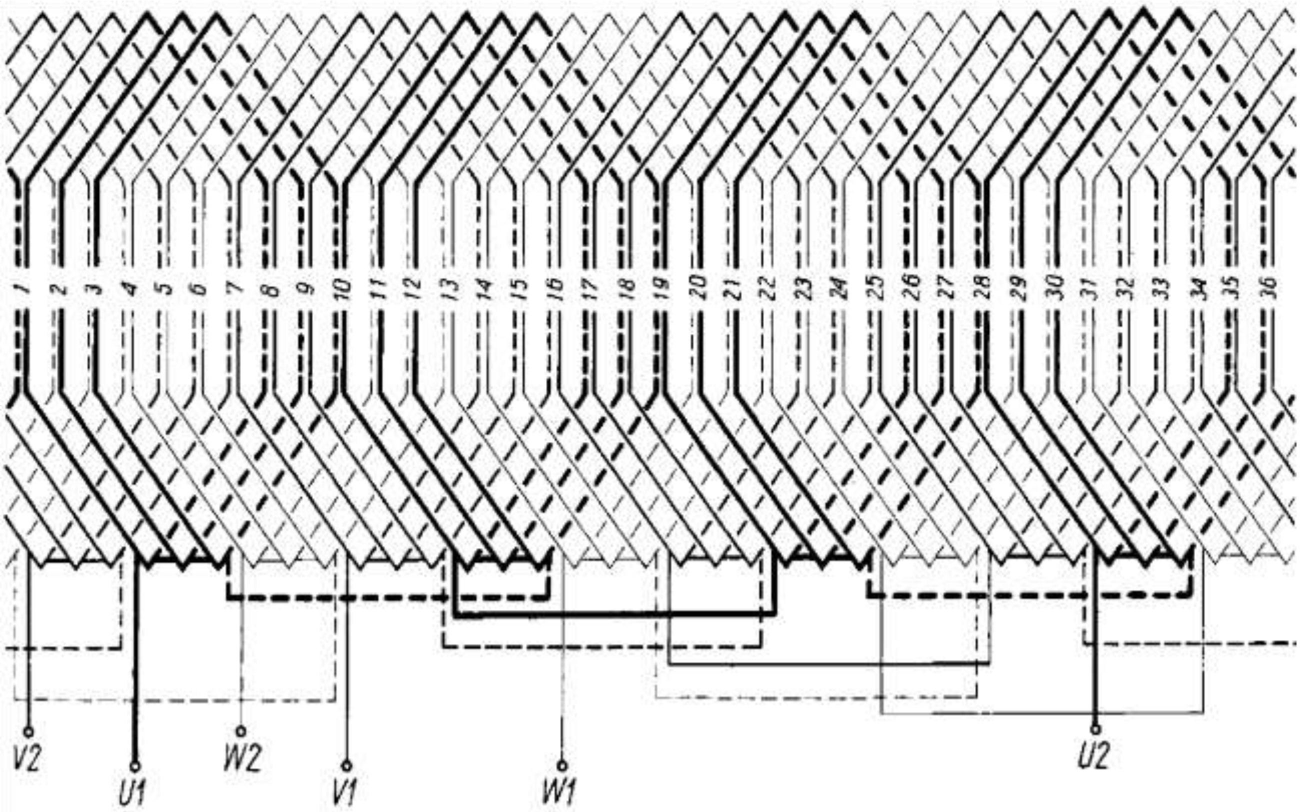


Figure. 73. Double Layer Lap Winding
Slots = 36; Poles = 2; y = 15; q = 6



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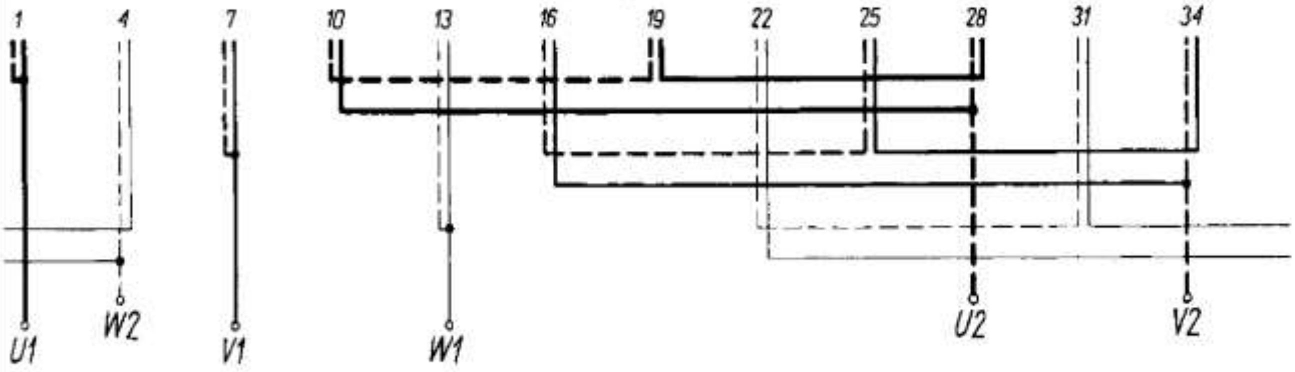

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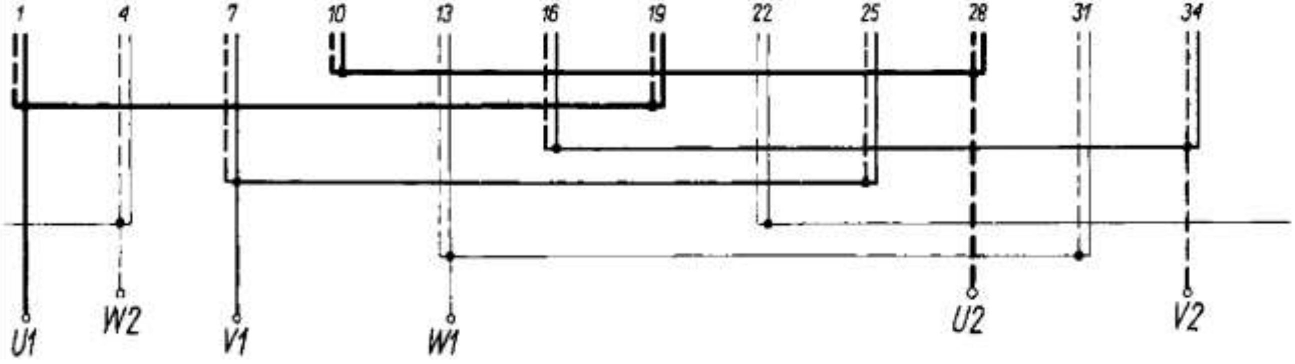


Figure. 74. Double Layer Lap Winding
Slots = 36; Poles = 4; y = 7; q = 3

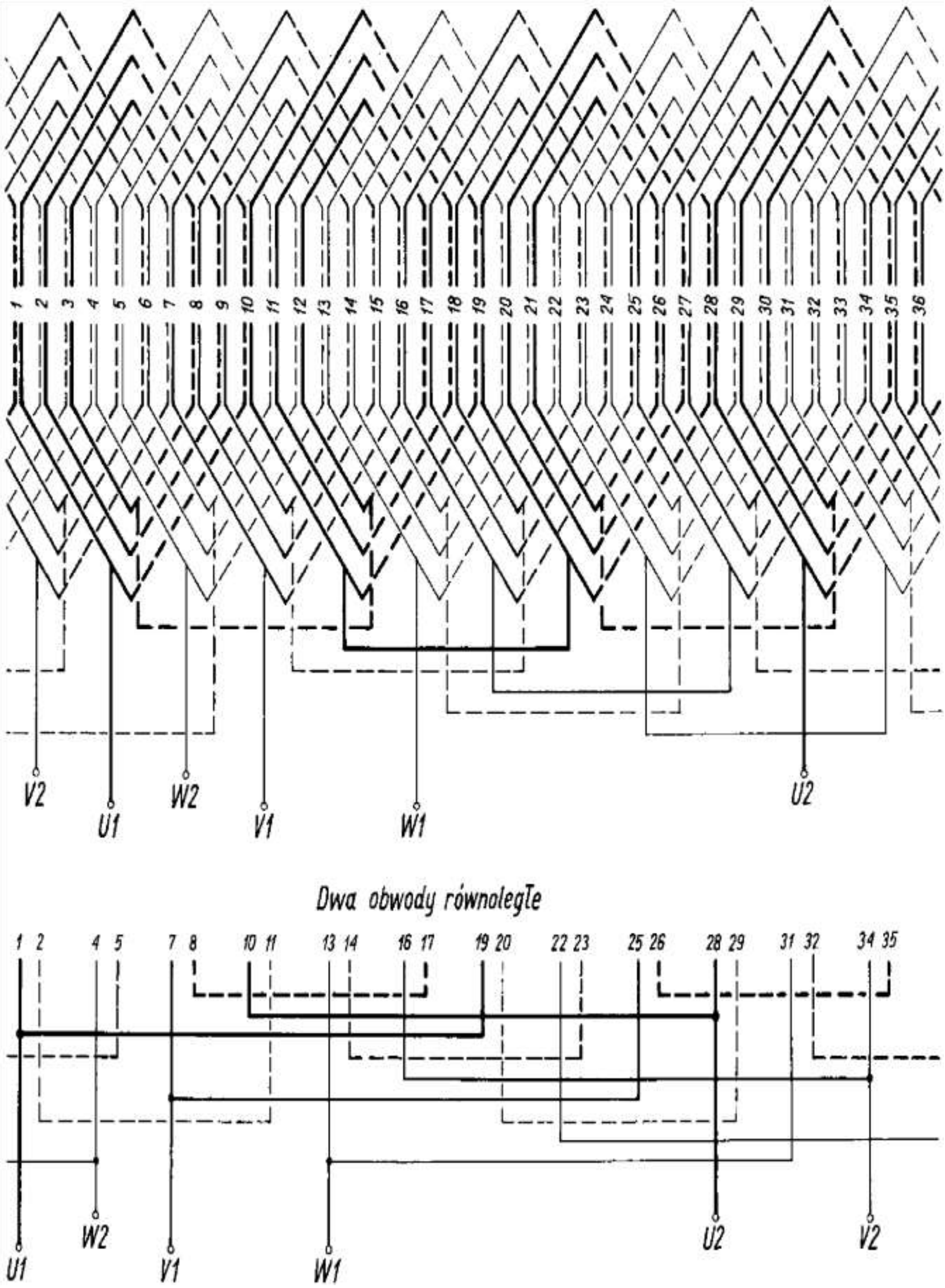
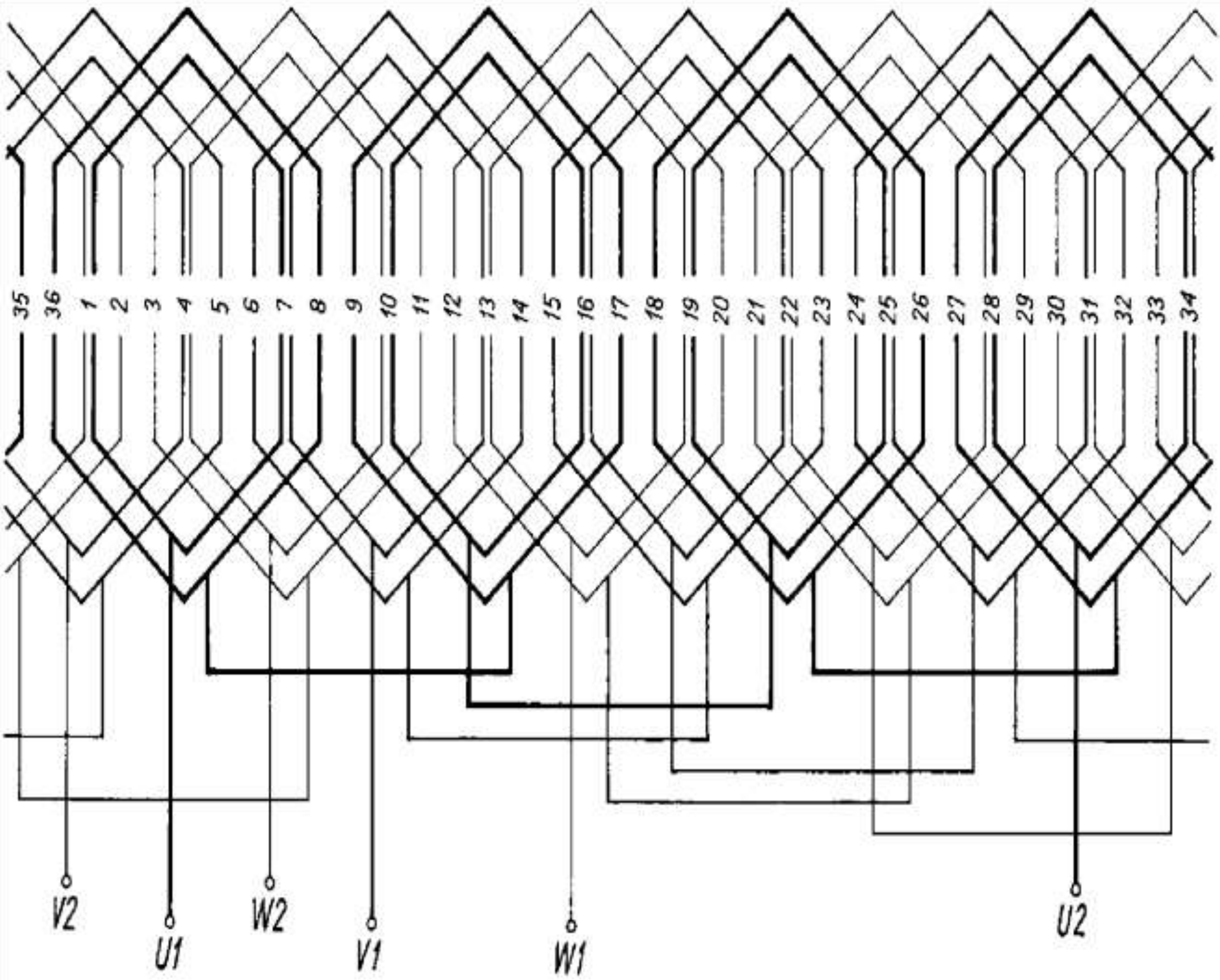


Figure. 74a. Concentric Double - Layer Winding

Slots = 36; Poles = 4; y = 5, 7, 9; q = 3



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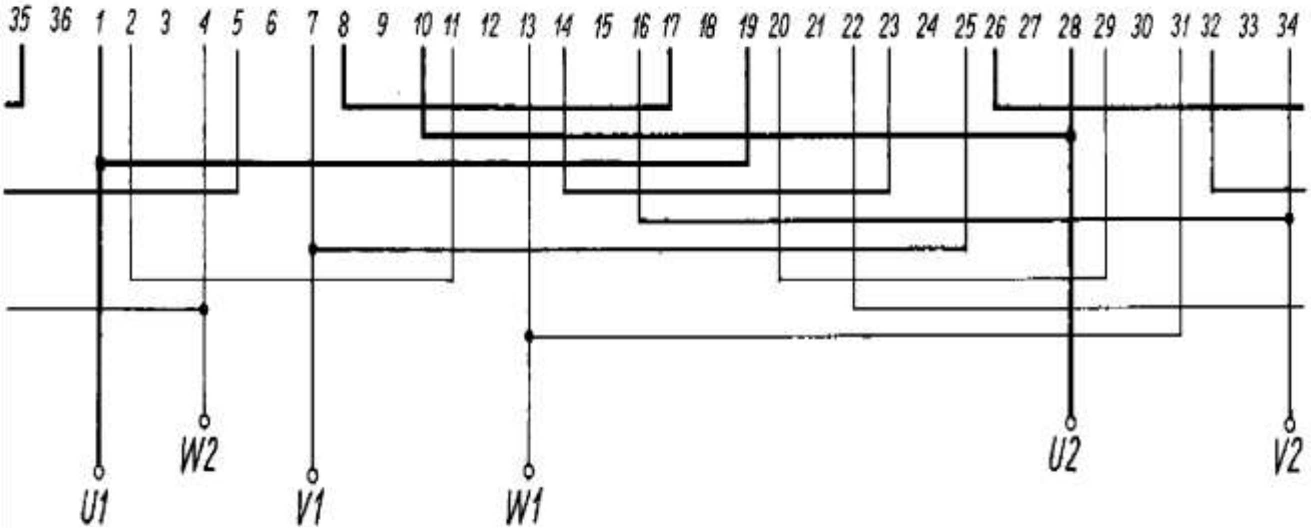
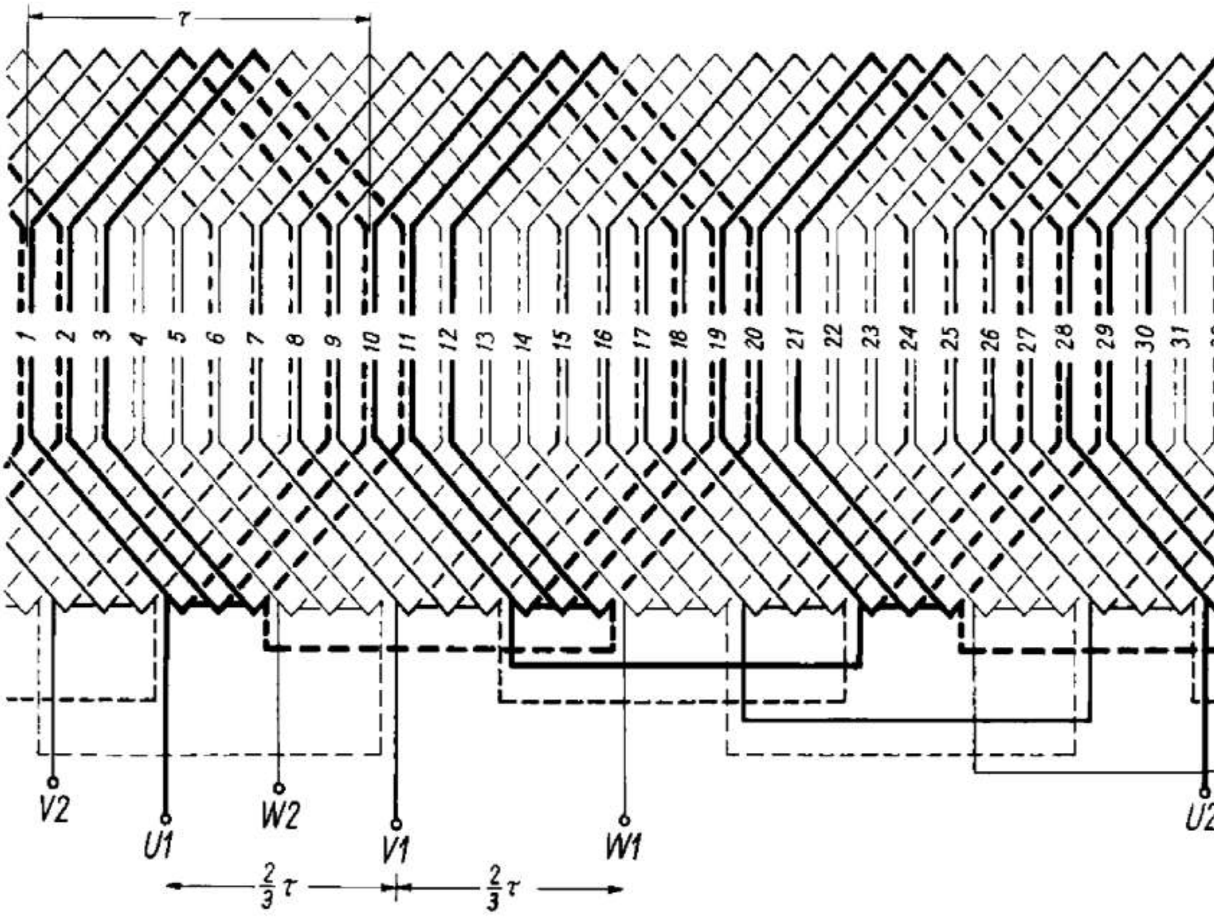


Figure. 74b. Concentric Double Layer Full / Half Coil, (½ coil on inside coil).
Slots = 36; Poles = 4; y = 6, 8; q = 3



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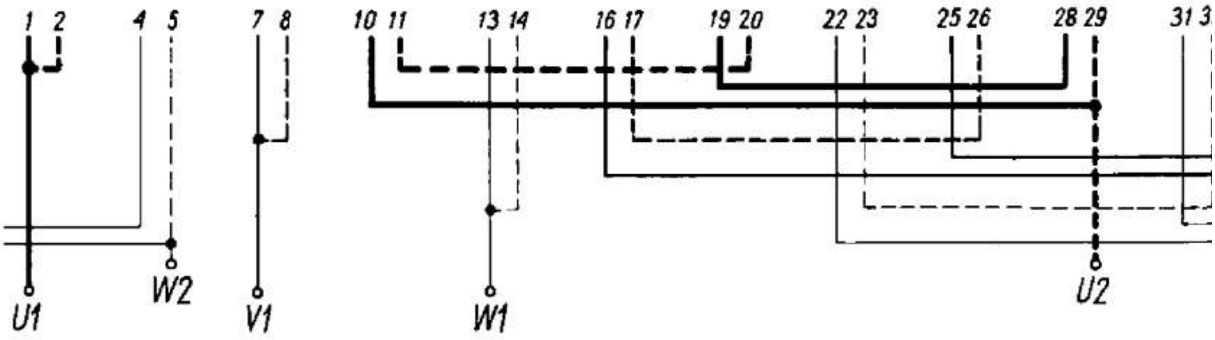

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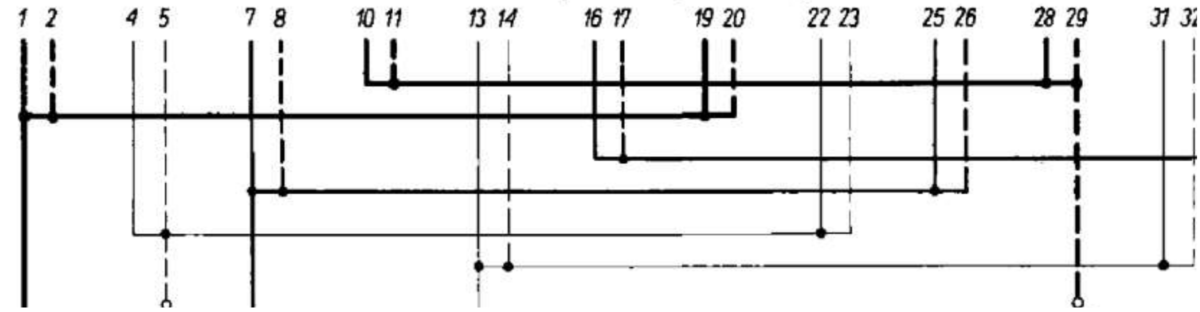
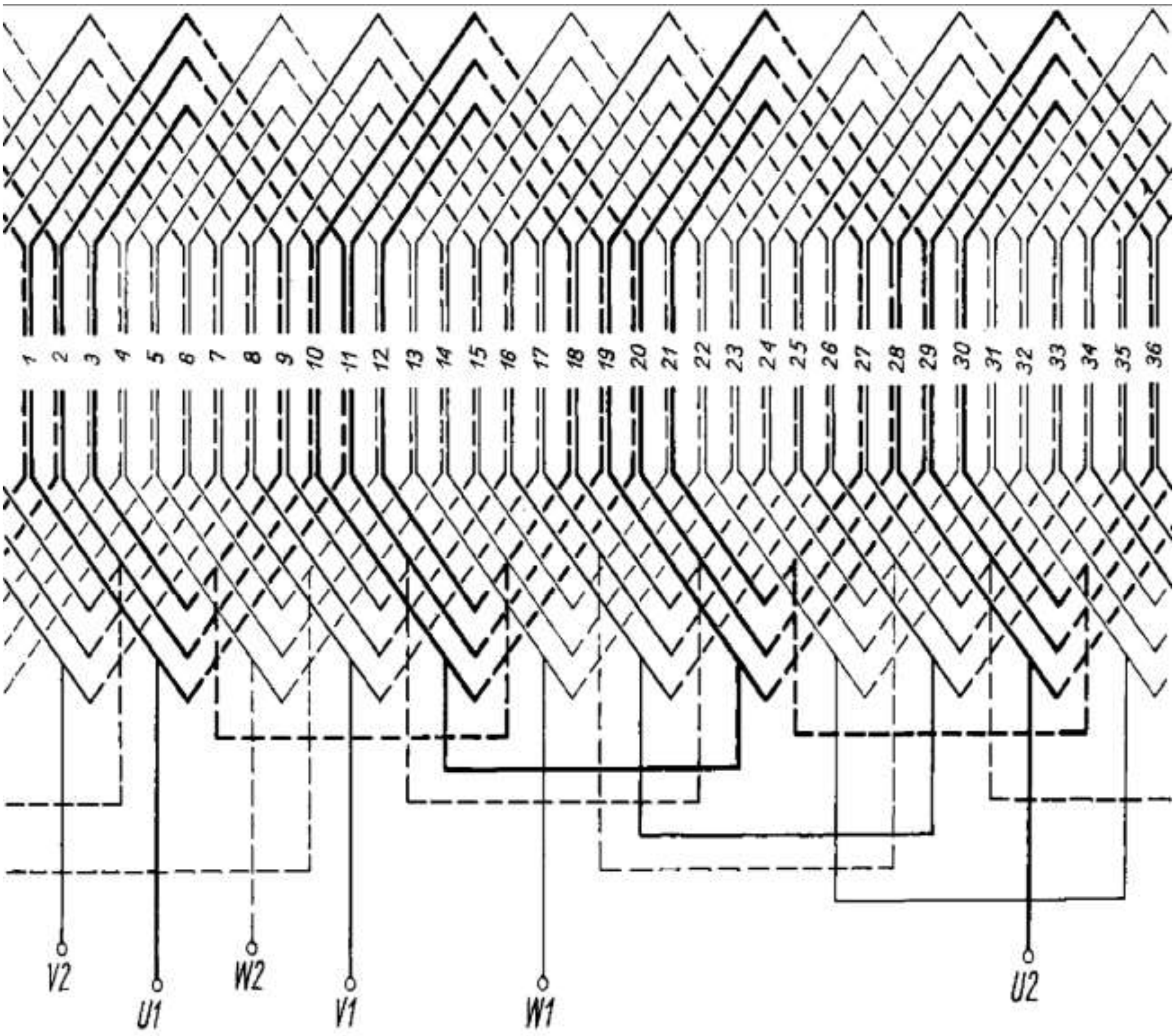


Figure.75. Double Layer Lap Winding
Slots = 36; Poles = 4; y = 8; q = 3



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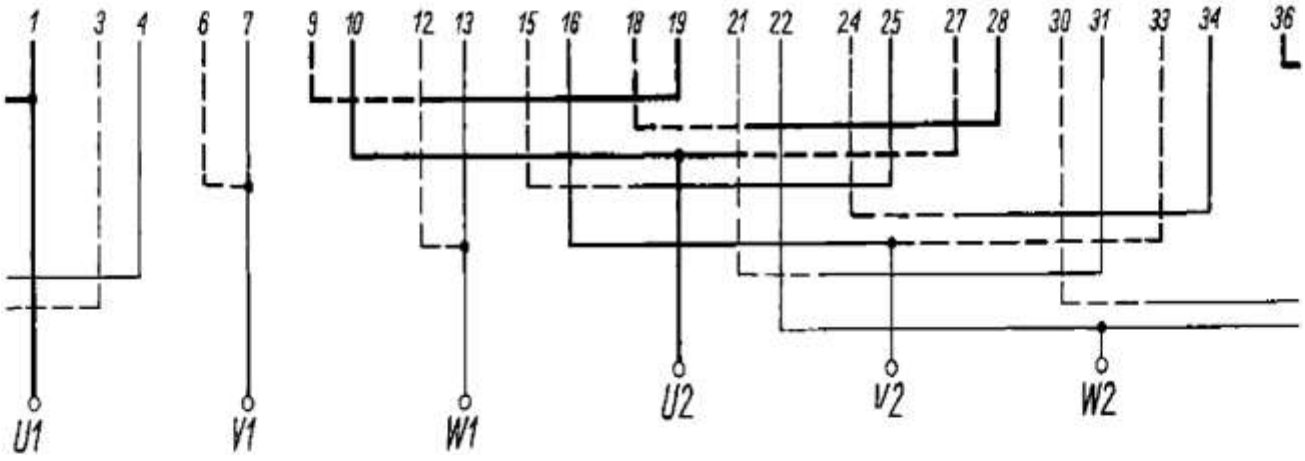
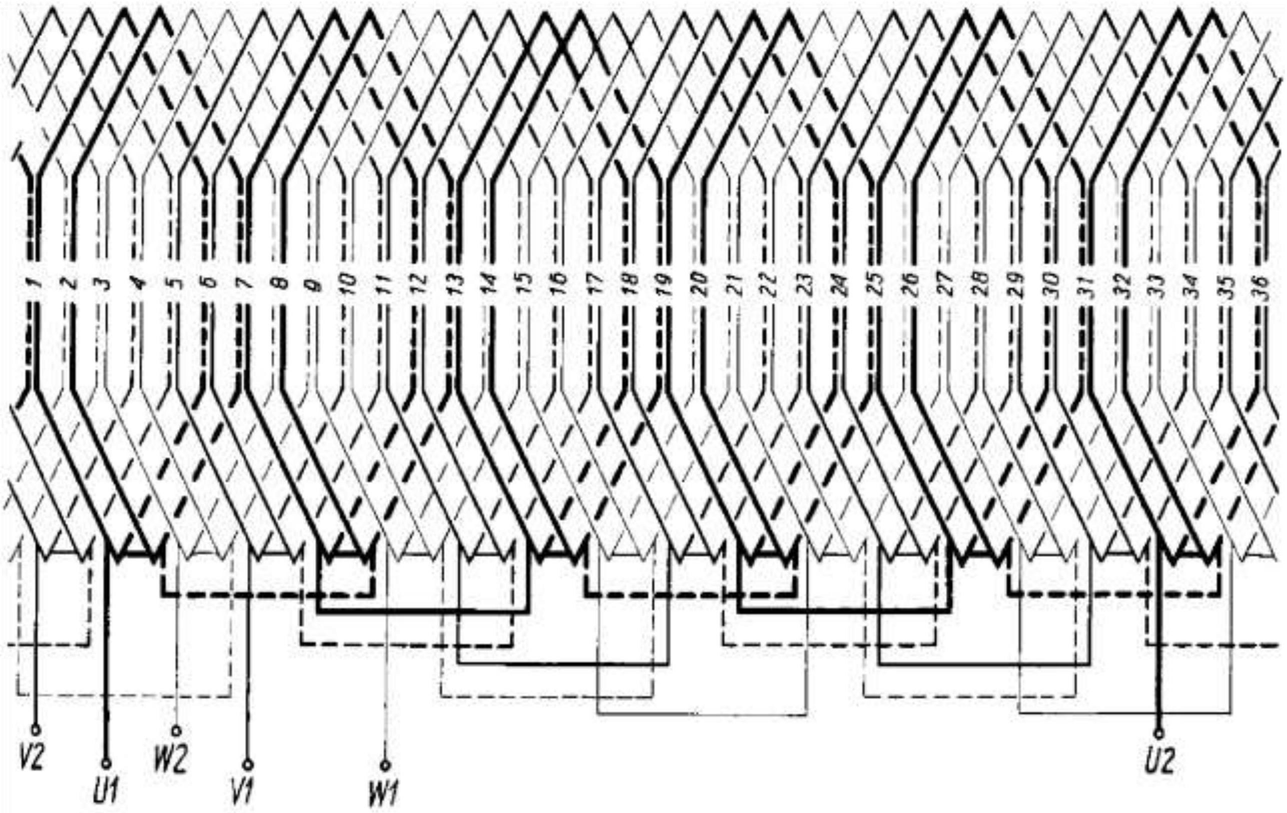


Figure.75a. Concentric Double Layer Winding
Slots = 36; Poles = 4; y = 6, 8, 10; q = 3



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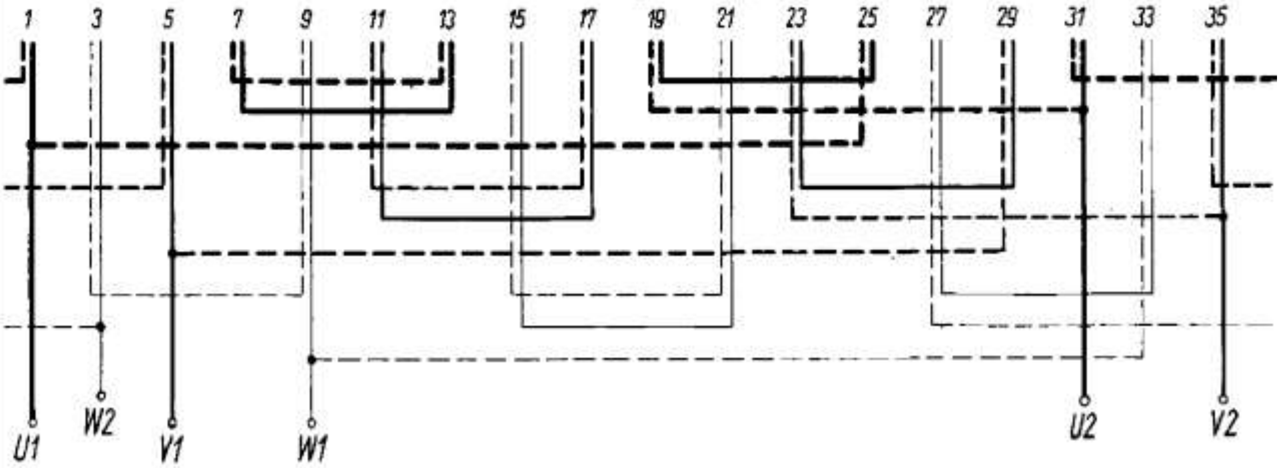

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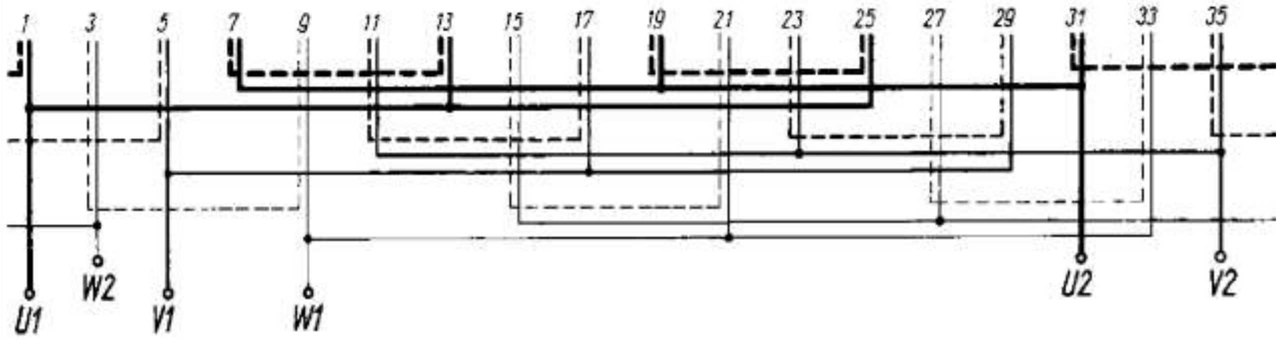
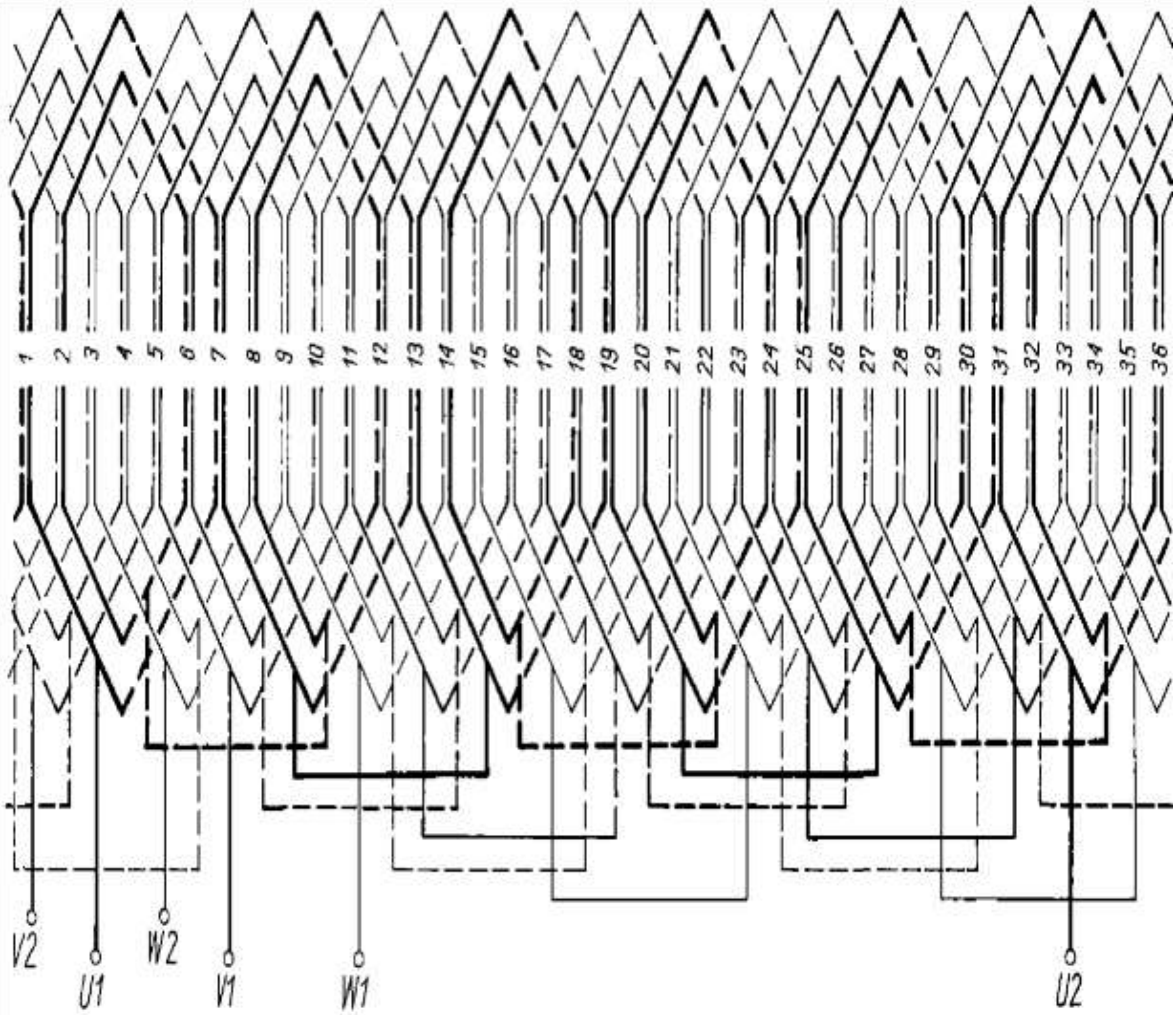


Figure.76. Double Layer Lap Winding
Slots = 36; Poles = 6; y = 5; q = 2



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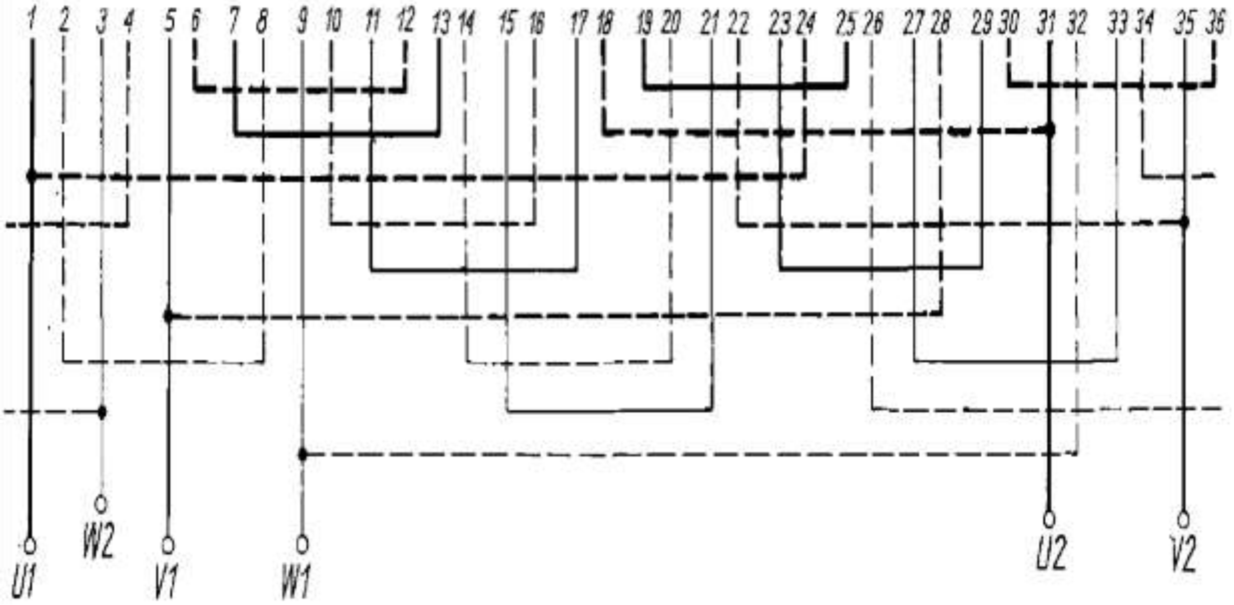
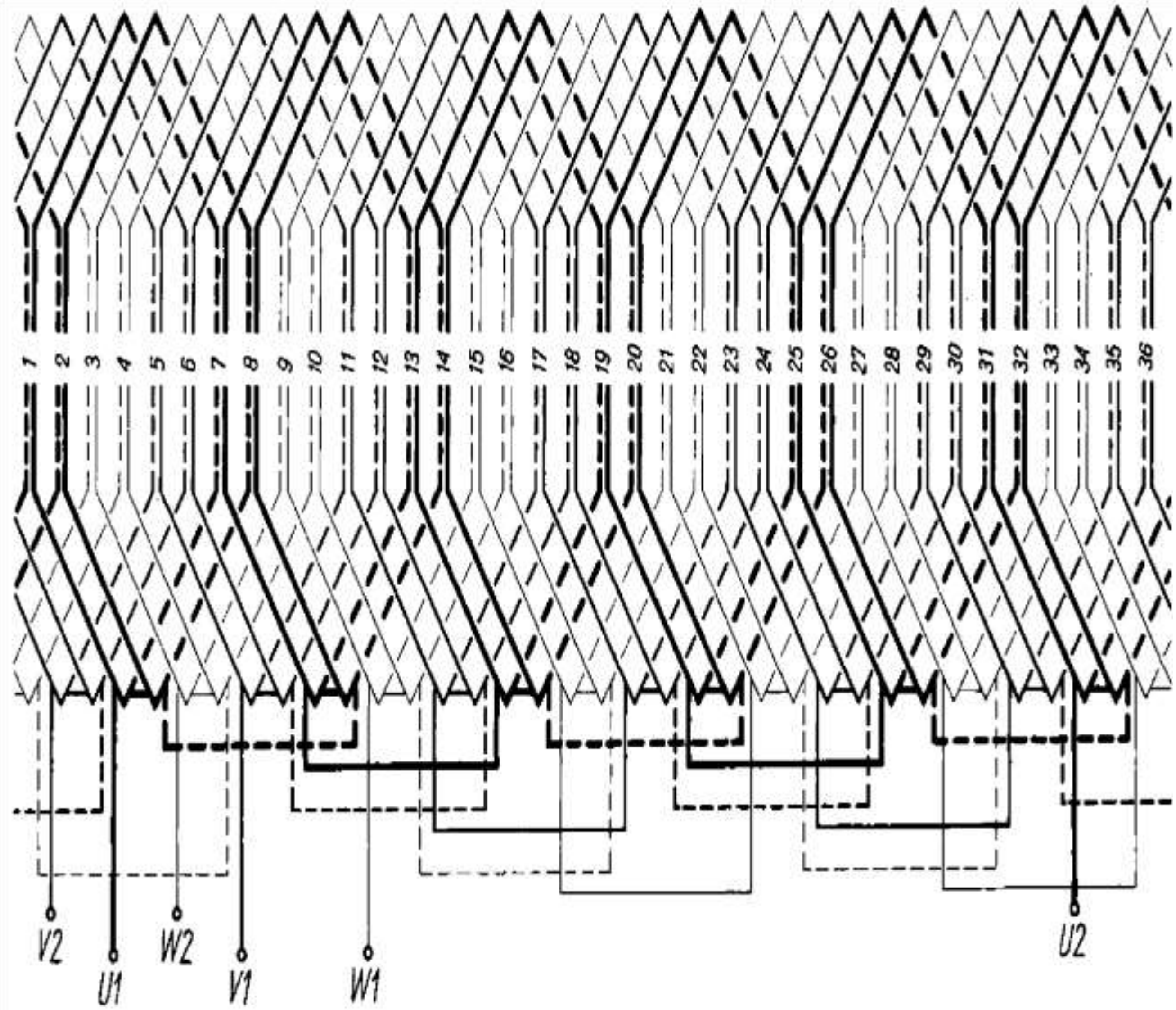


Figure.76a. Concentric Double Layer Winding
Slots = 36; Poles = 6; y = 4, 6; q = 2



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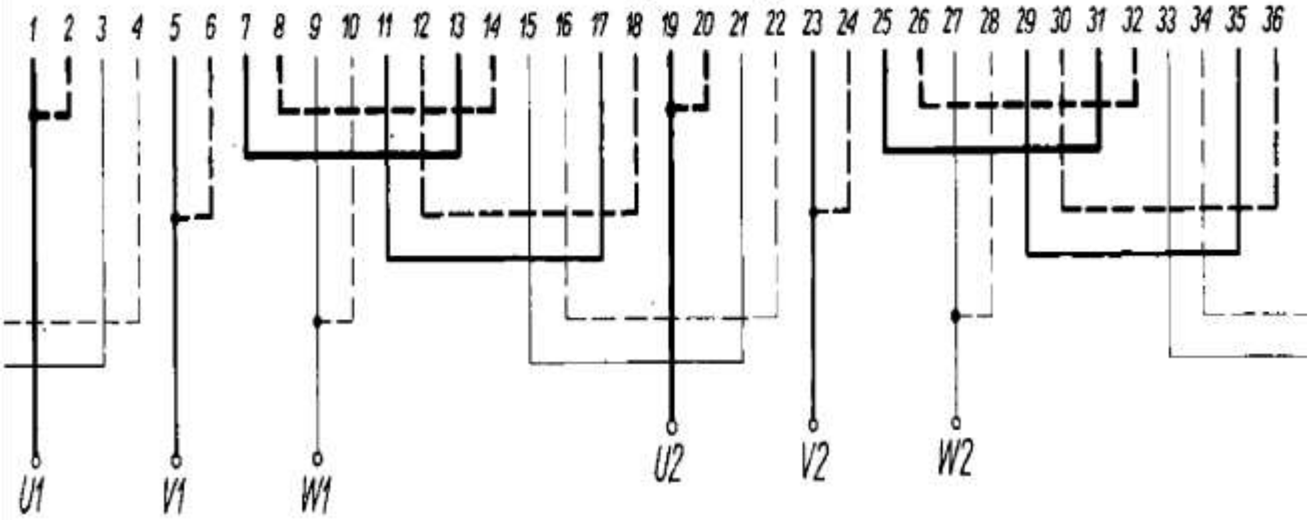
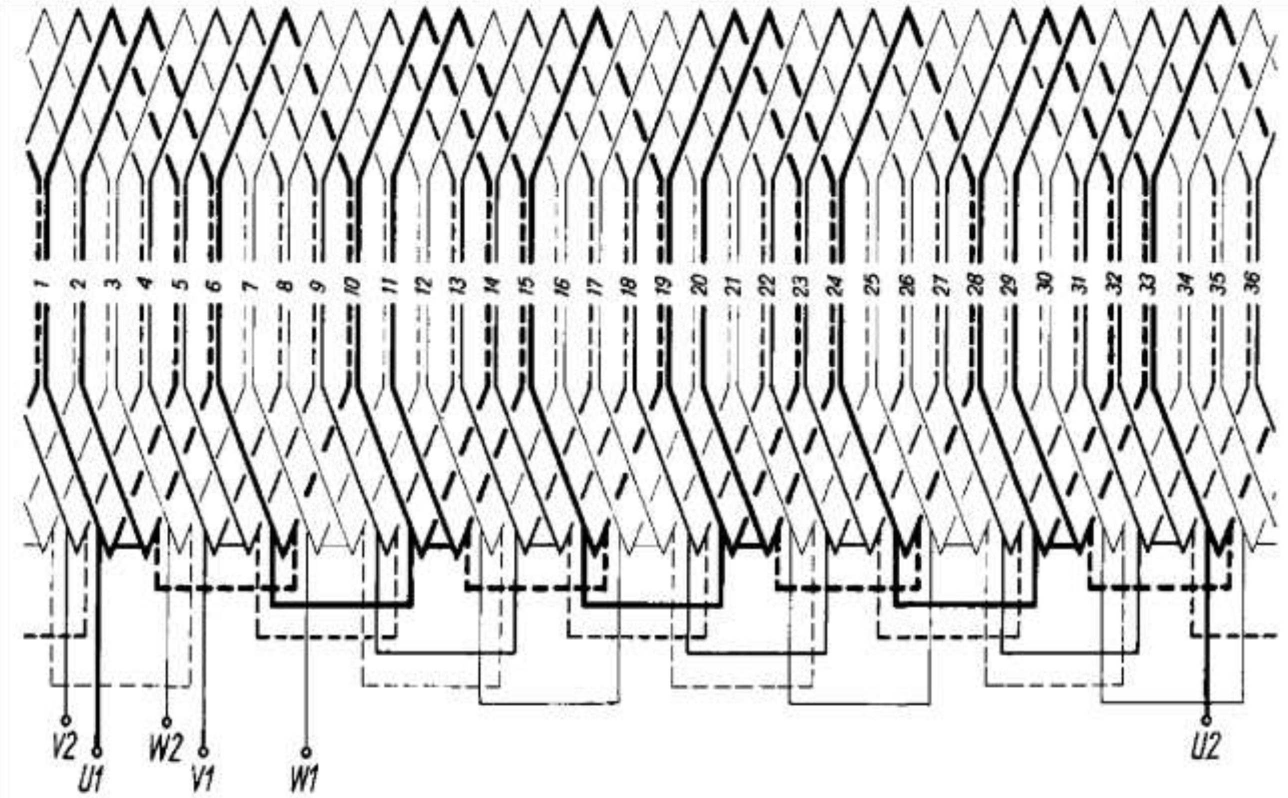


Figure.77. Double Layer Lap Winding
Slots = 36; Poles = 6; y = 6; q = 2



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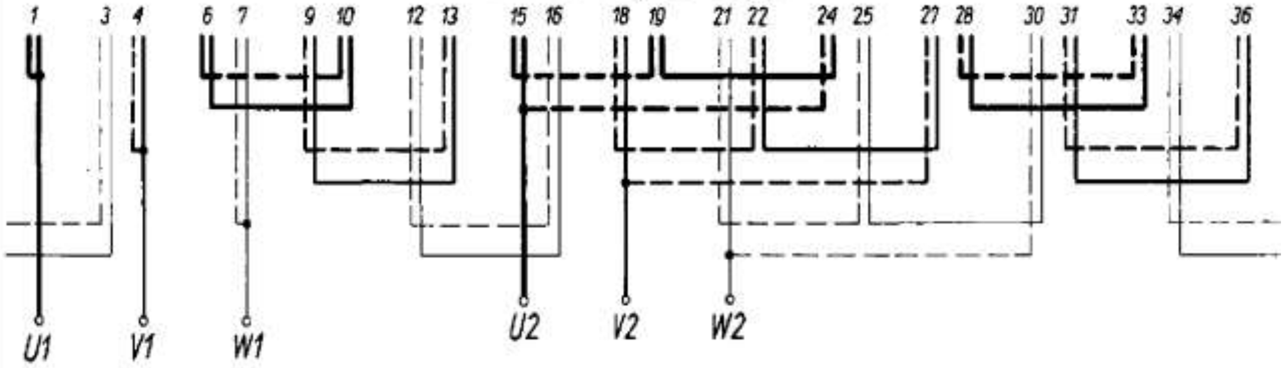


Cztery obwody równoległe

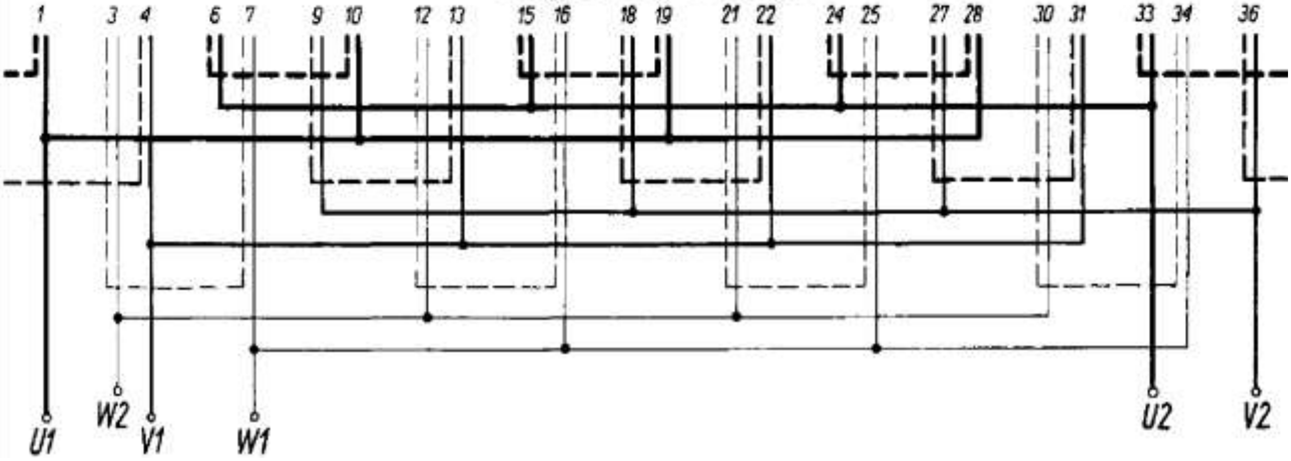
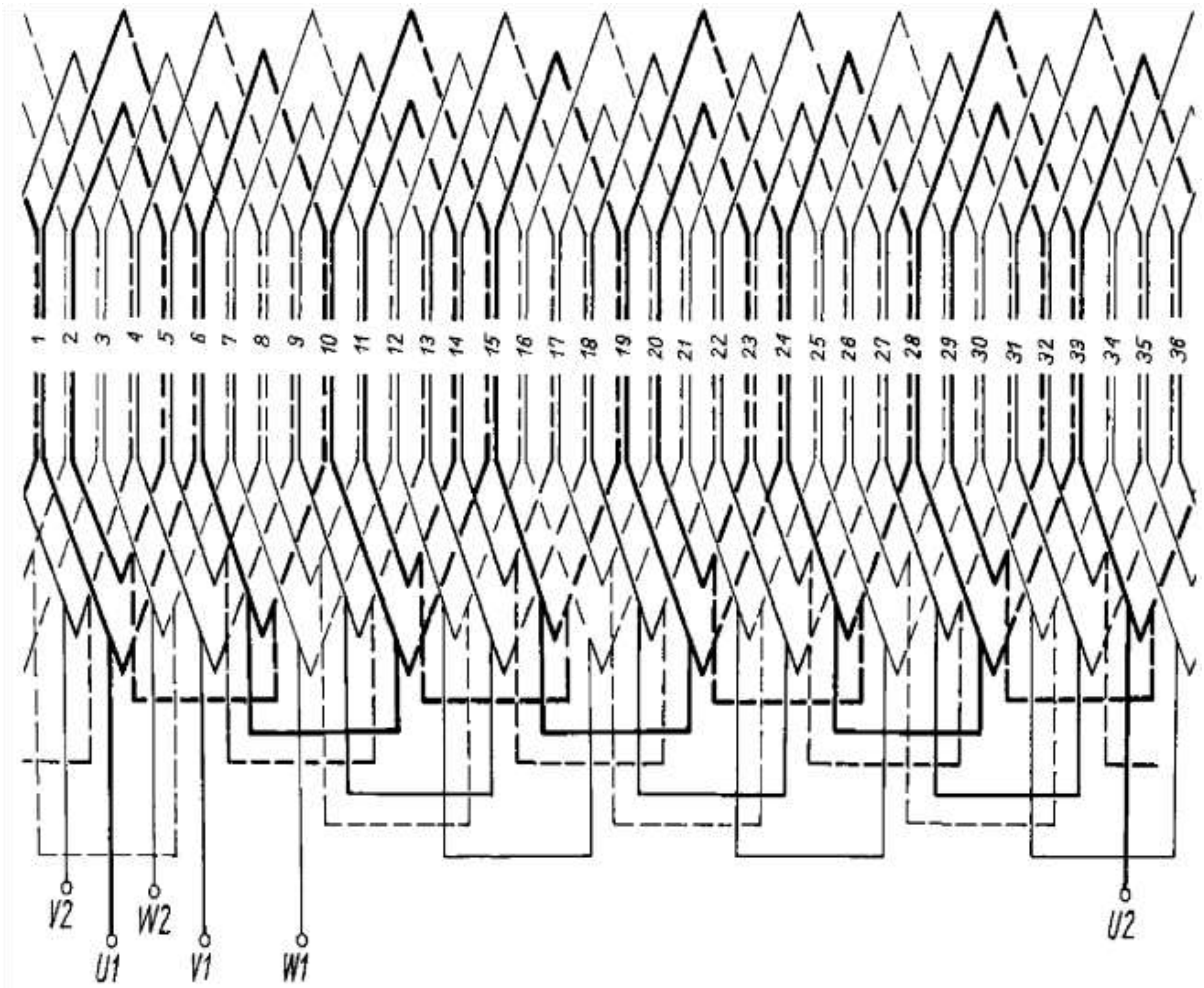


Figure.78. Double Layer Lap Winding (Odd Grouping)
Slots = 36; Poles = 8; y = 4; q=1 $^{1}/_{2}$



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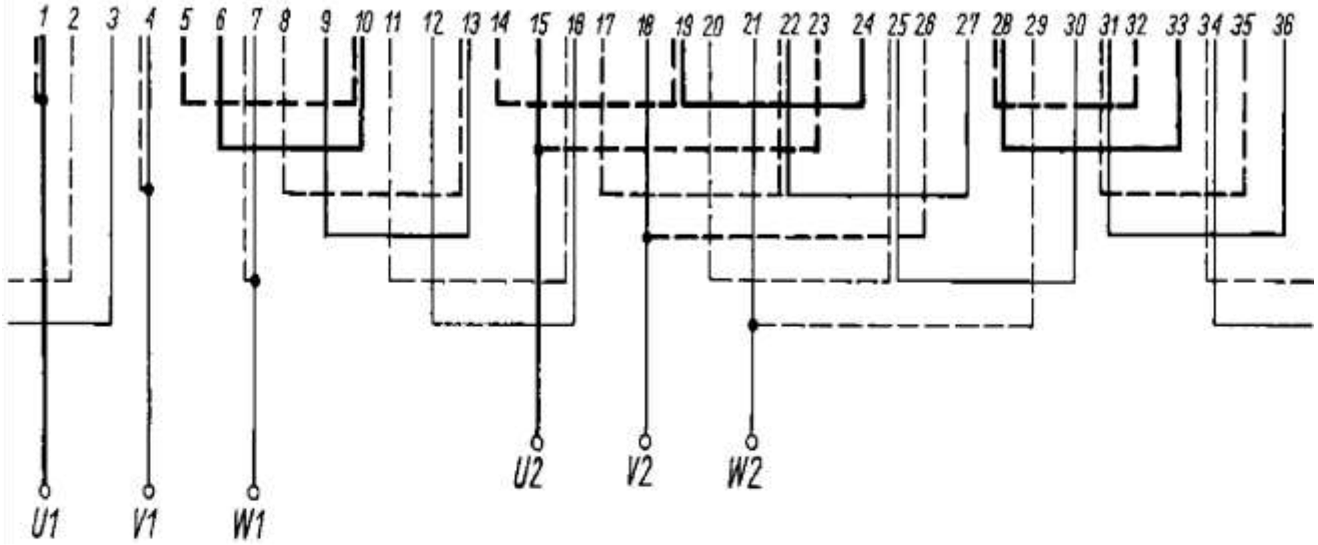
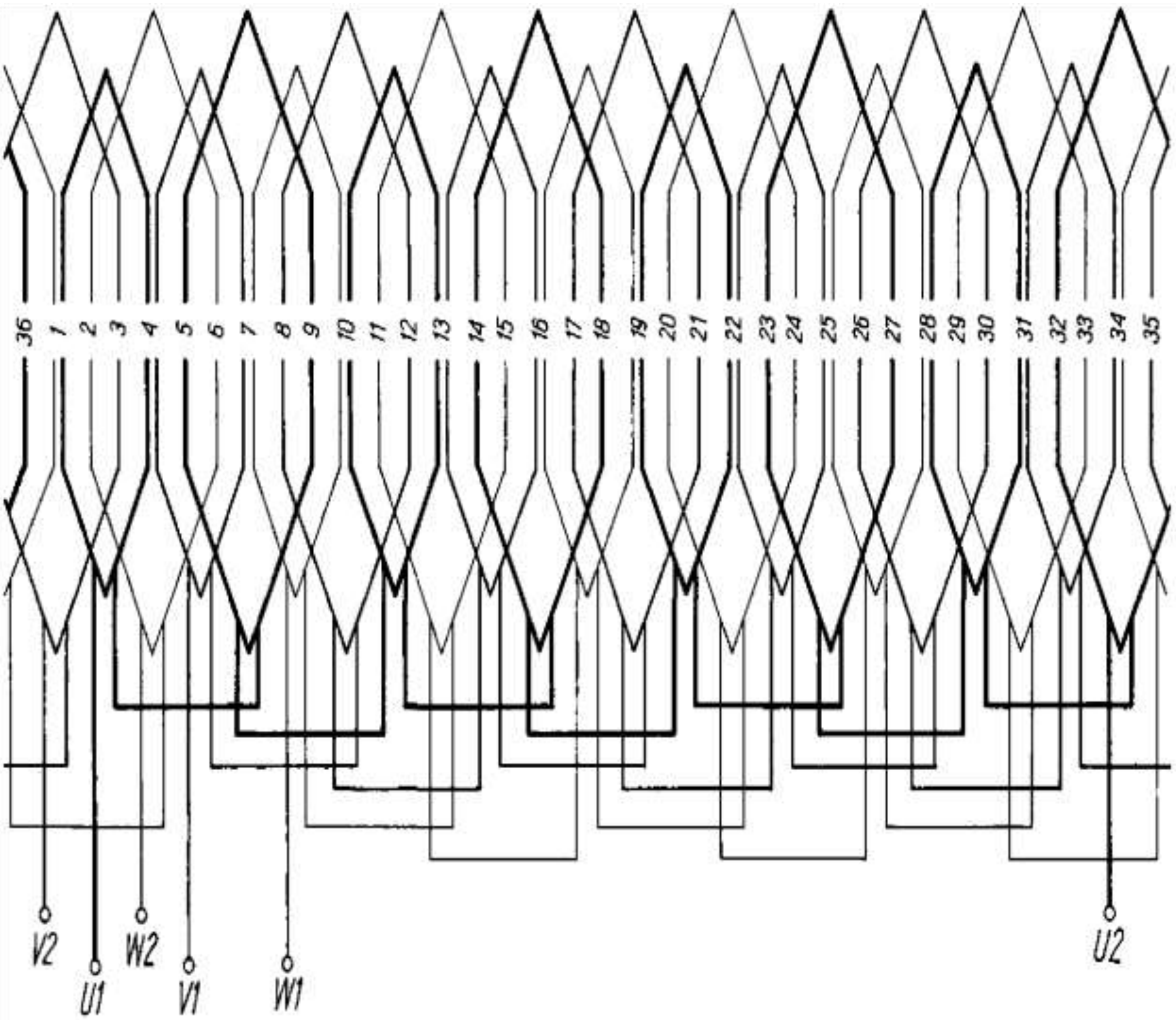


Figure.78a. Concentric Double Layer Winding
Slots = 36; Poles = 8; y = 3, 4, 5; q = 1 $^1/_2$



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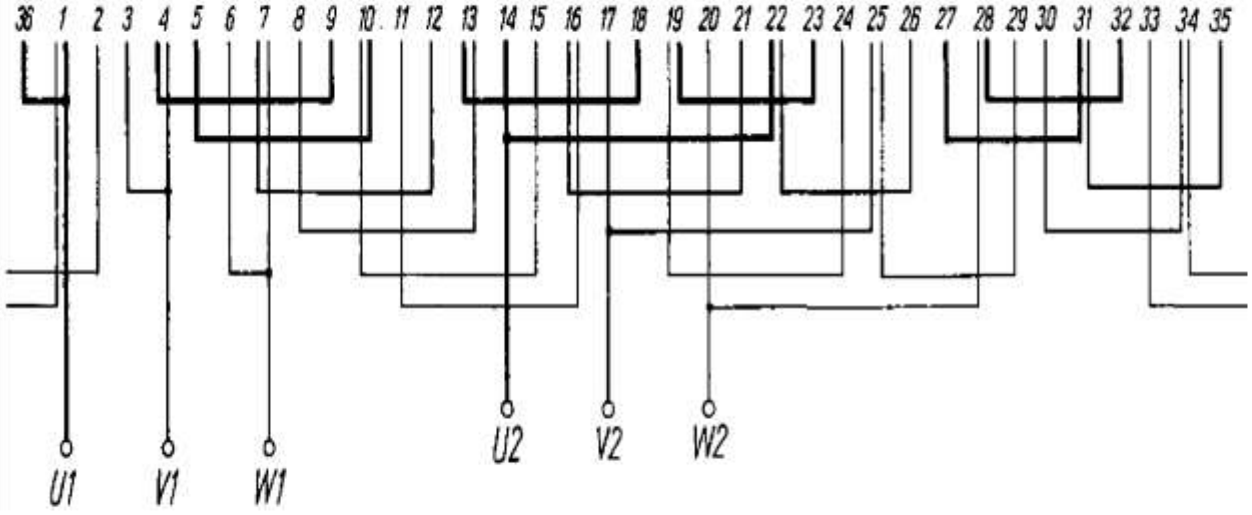
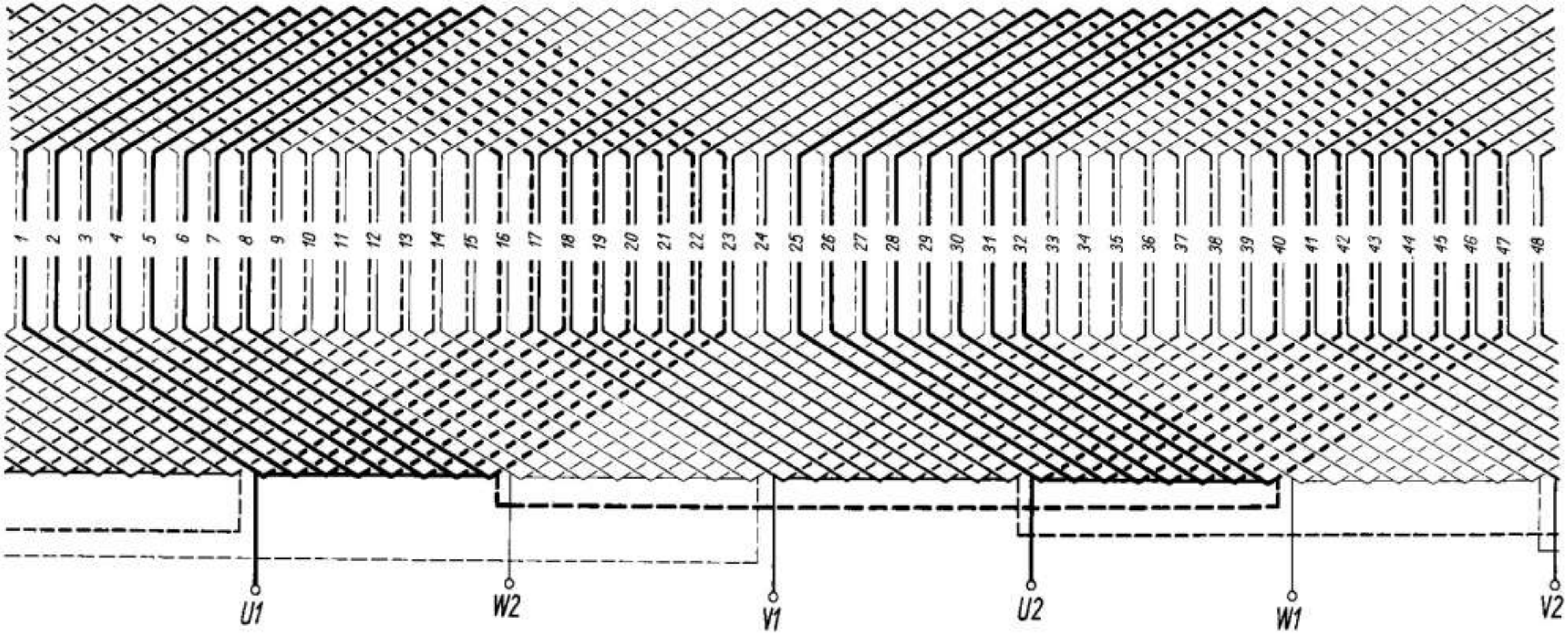


Figure.78b. Concentric Double Layer Full / Half Coil
Slots = 36; Poles = 8; y = 3, 4; q = $1\,{}^{1}/_{2}$



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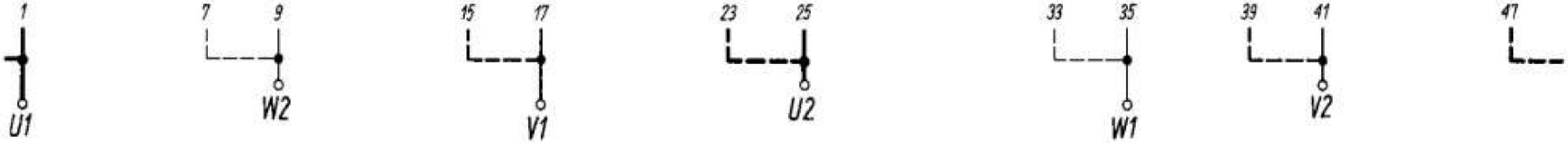


Figure. 79. Double Layer Lap Winding
Slots = 48; Poles = 2; y = 15; q = 8

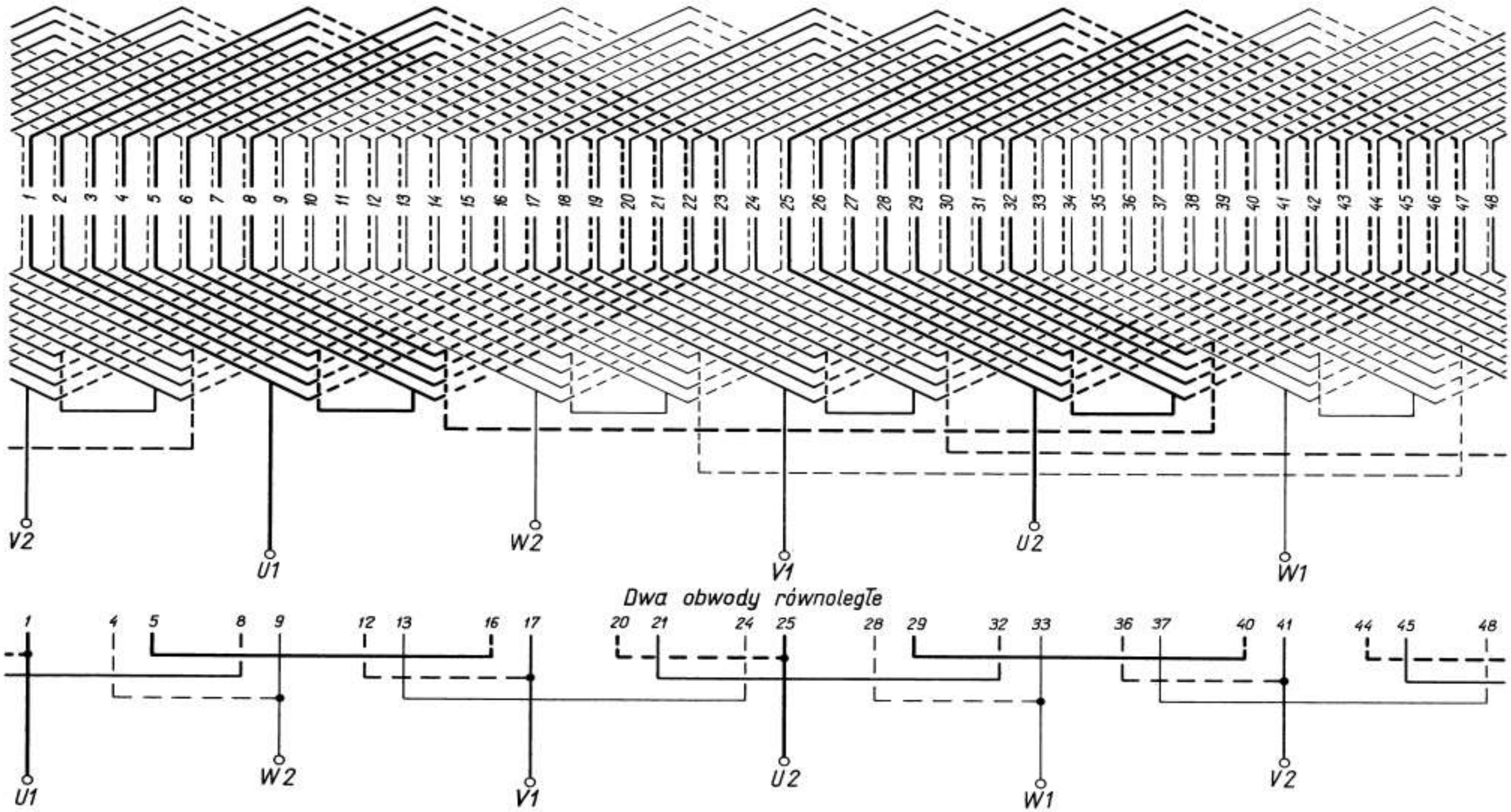


Figure. 79a. Concentric Double - Layer Winding with split groups
Slots = 48; Poles = 2; y = 12, 14, 16, 18; q = 8

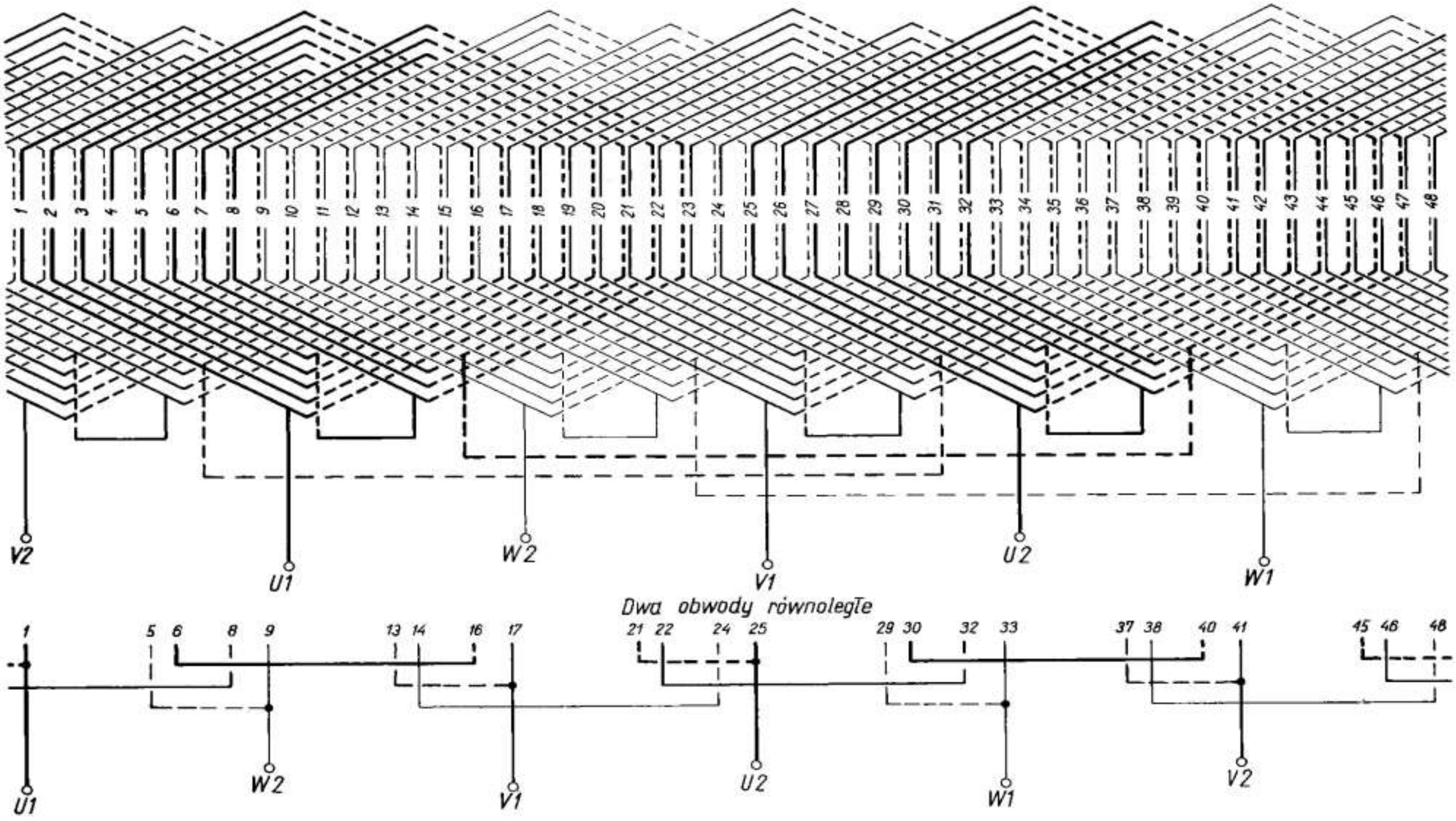
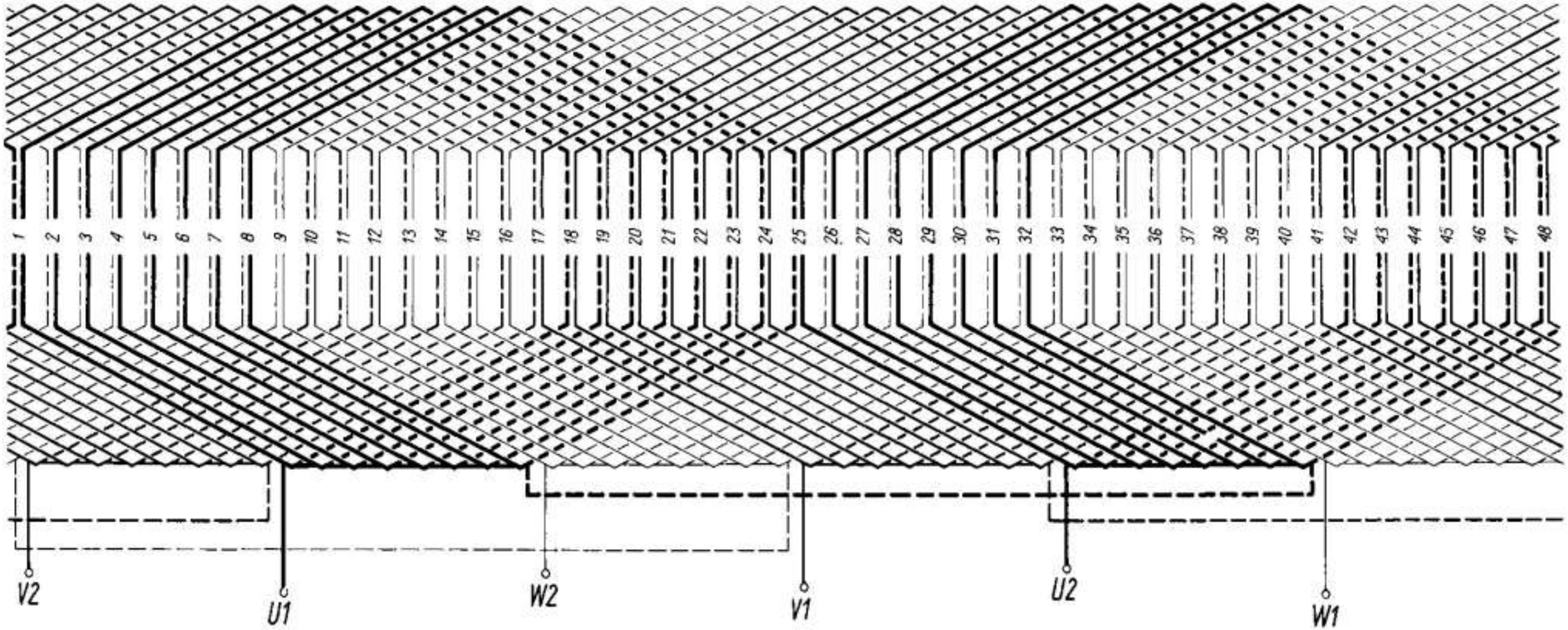


Figure. 79b. Concentric Double - Layer Winding with split / odd Grouping

Slots = 48; Poles = 2; y = 11, 13, 15, 17, 19/13, 15, 17; q = 8



Dwa obwody równoległe

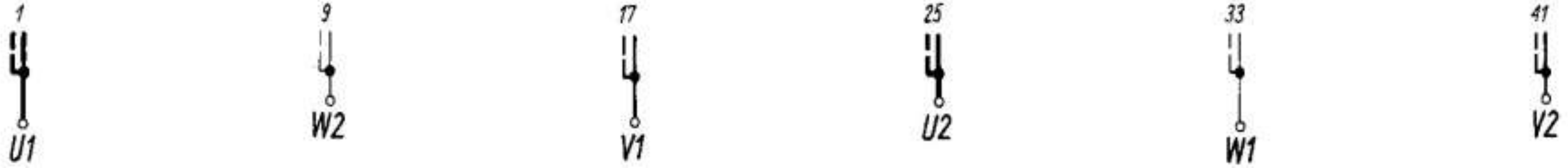


Figure. 80. Double Layer lap Winding
Slots = 48; Poles = 2; y = 17; q = 8

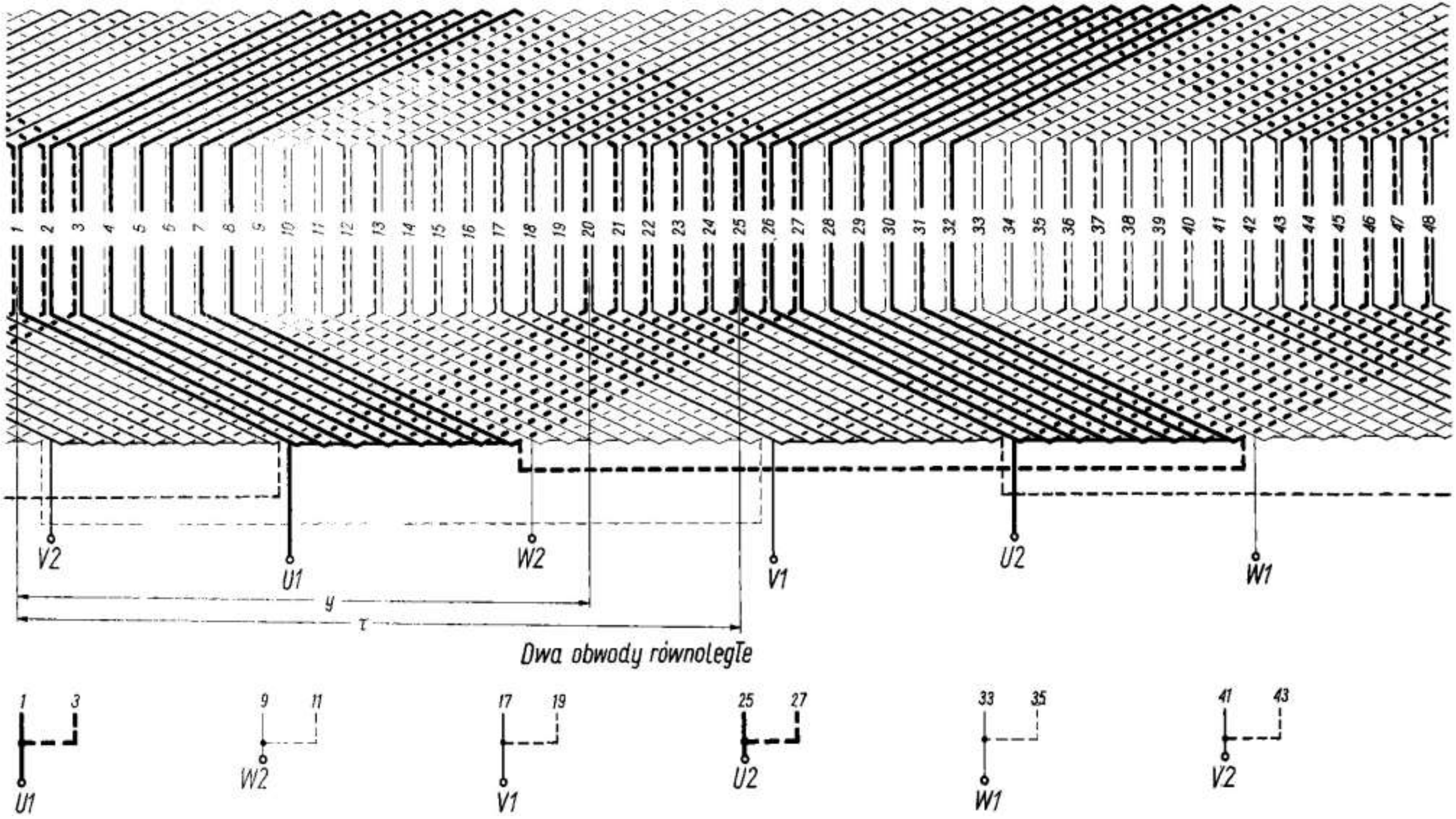
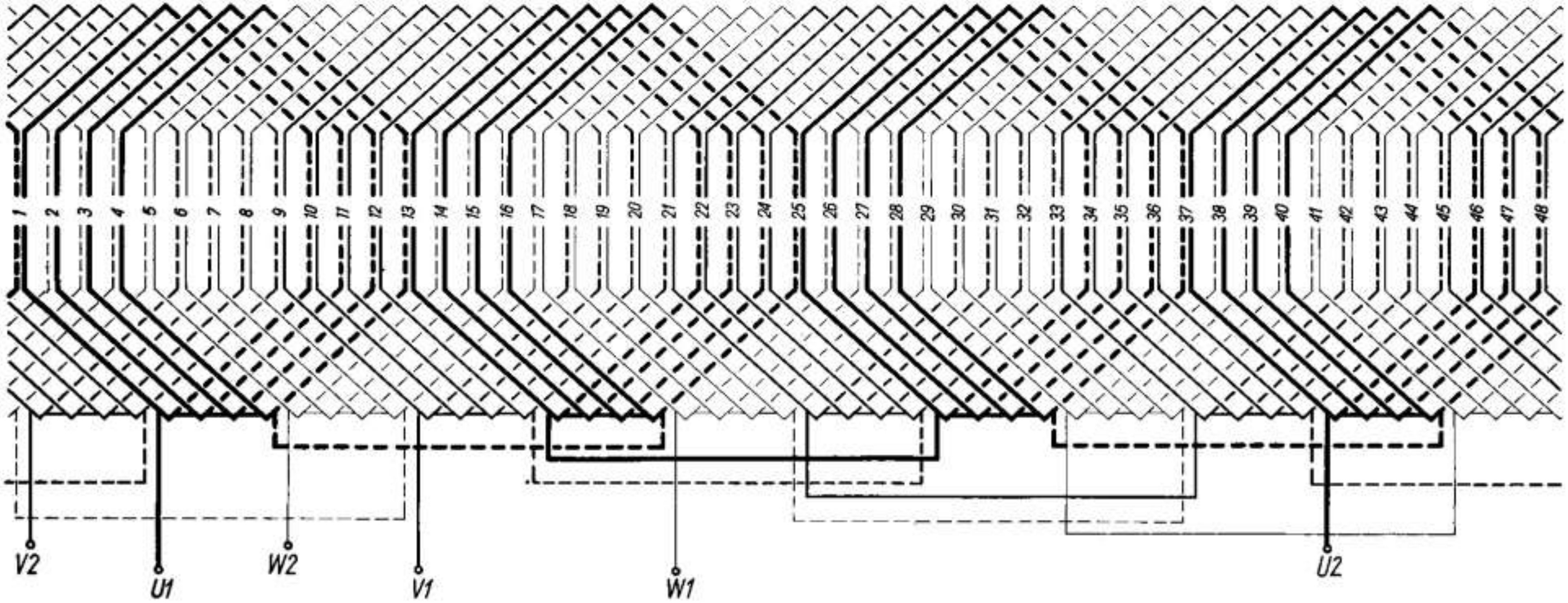


Figure. 81. Double Layer Lap Winding
Slots = 48; Poles = 2; y = 19; q = 8



Dwa obwody równoległe

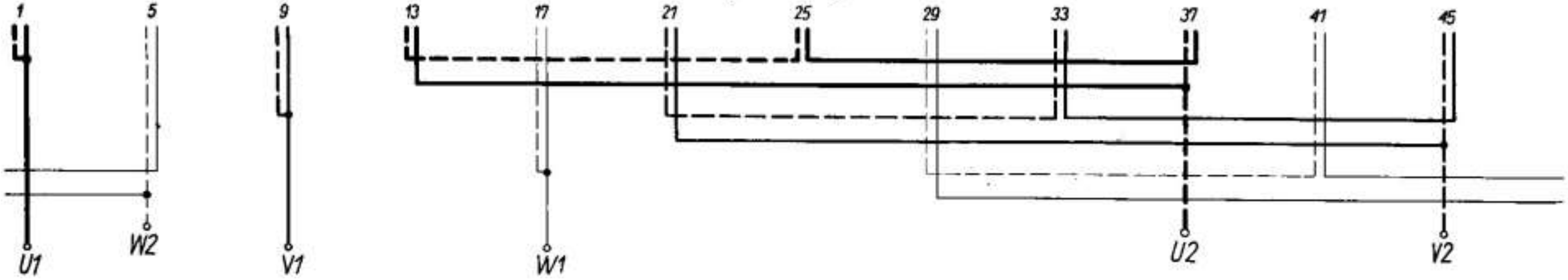
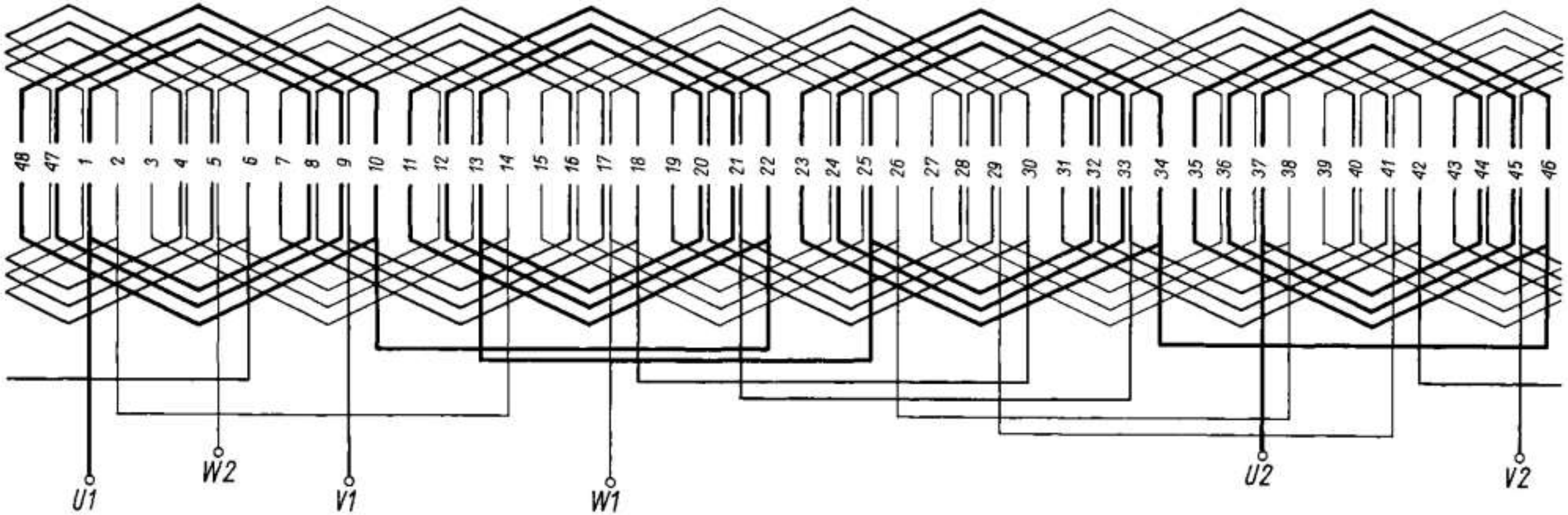


Figure. 82. Double Layer Lap Winding
Slots = 48; Poles = 4; y = 9; q = 4



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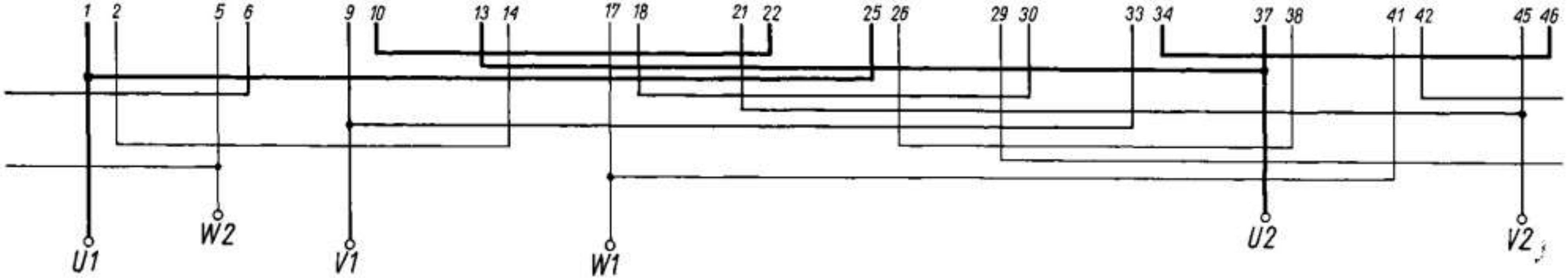
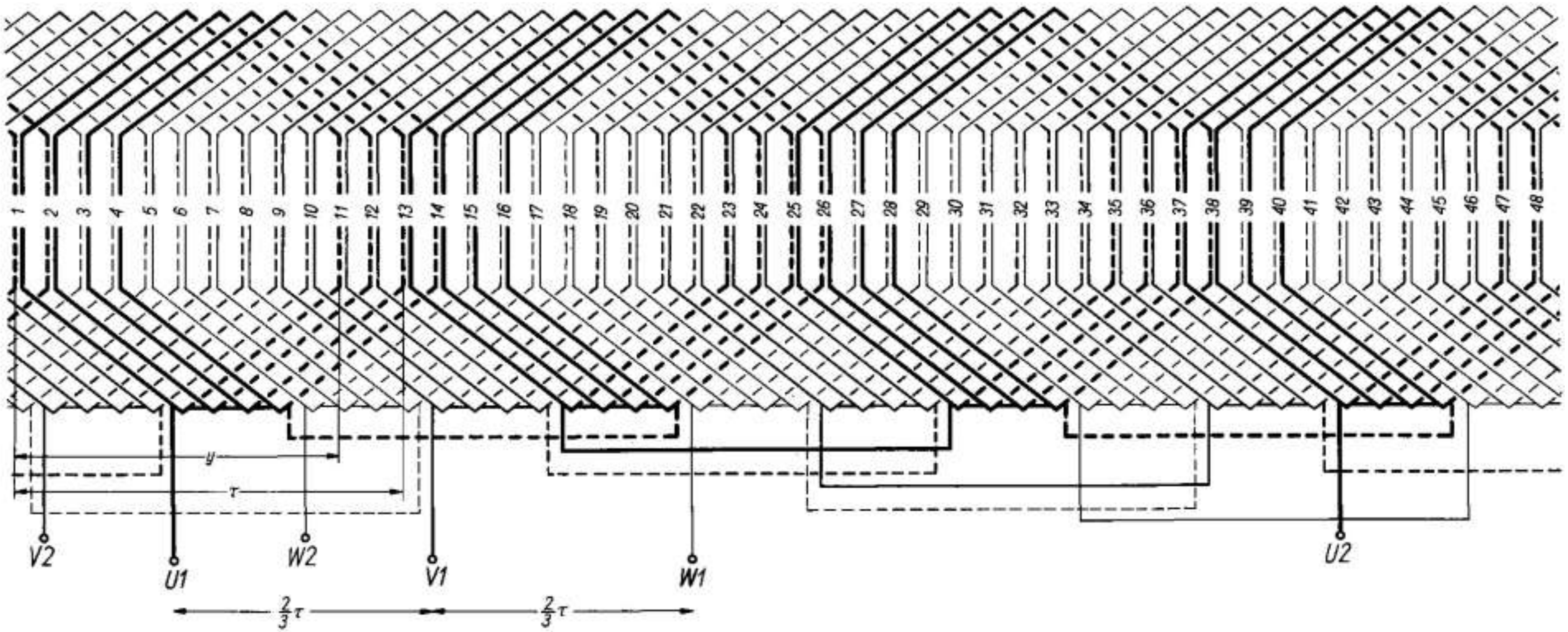


Figure. 82a. Concentric Double-Layer with Full / Half Coil
Slots= 48; Poles = 4; y = 7, 9, 11; q = 4



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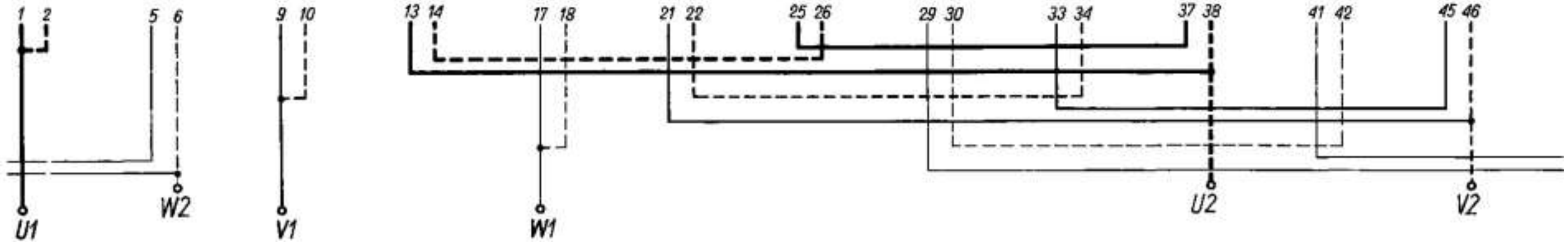
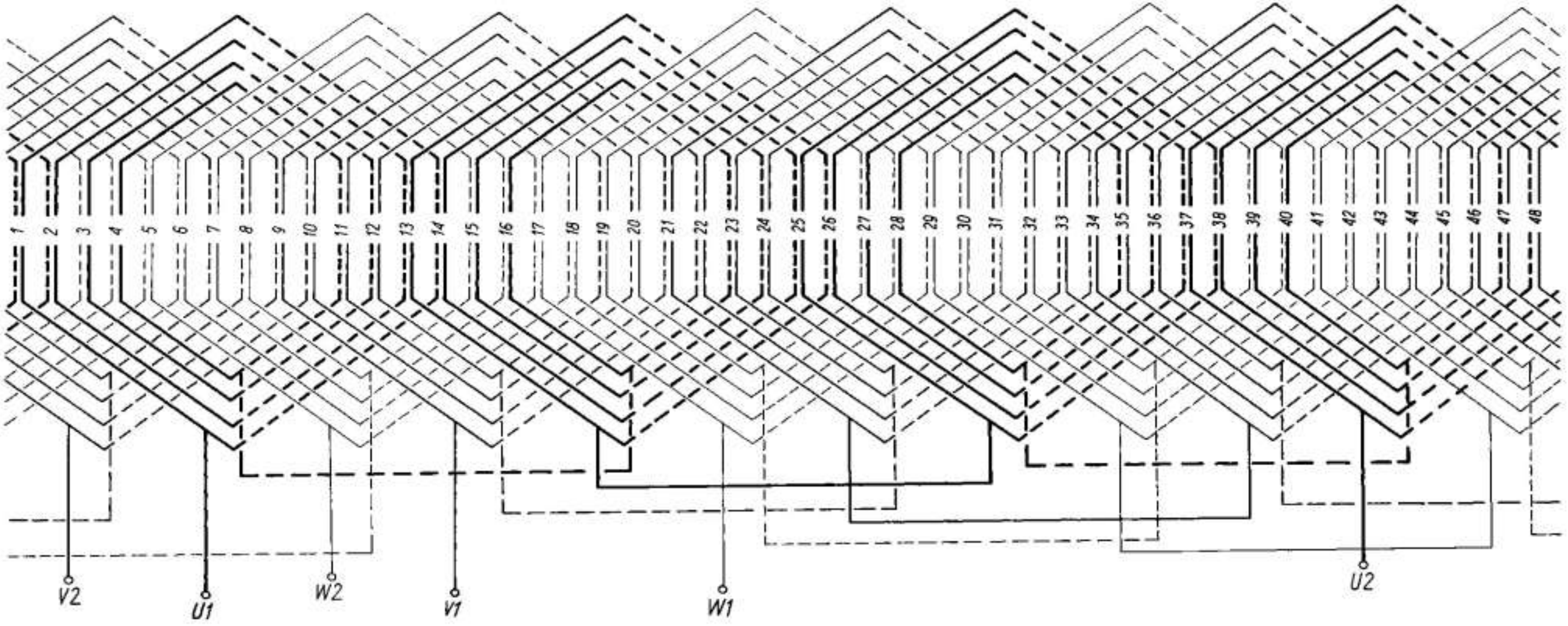


Figure. 83. Double Layer Lap Winding
Slots = 48; Poles = 4; y = 10; q = 4



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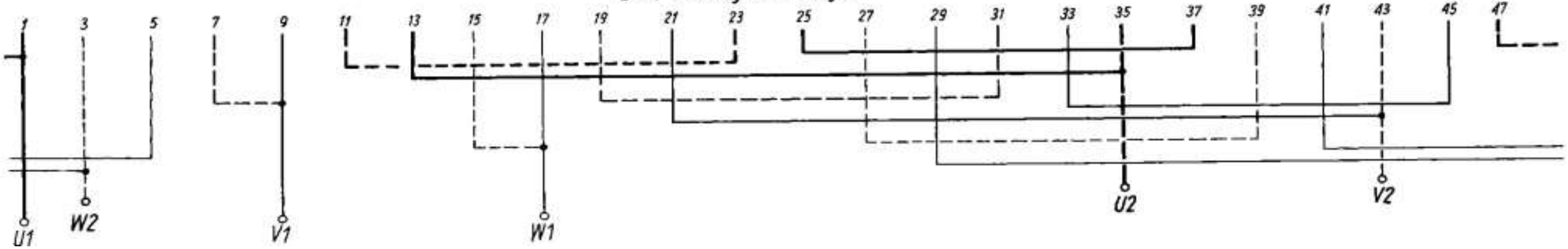


Figure. 83a. Concentric Double - Layer Winding
Slots = 48; Poles = 4; y = 7, 9, 11, 13; q = 4

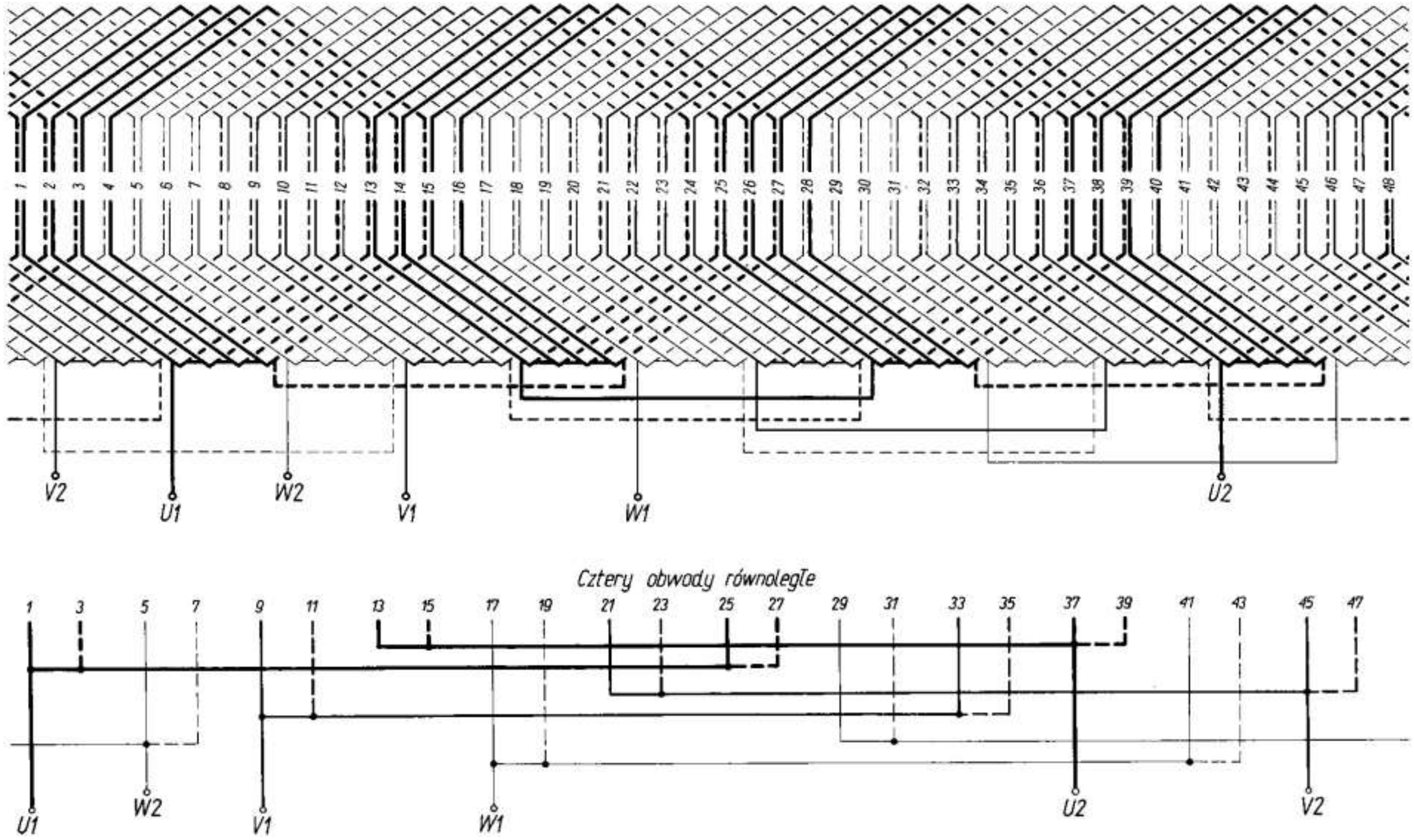


Figure. 84. Double Layer Lap Winding
Slots = 48; Poles = 4; y = 11; q = 4

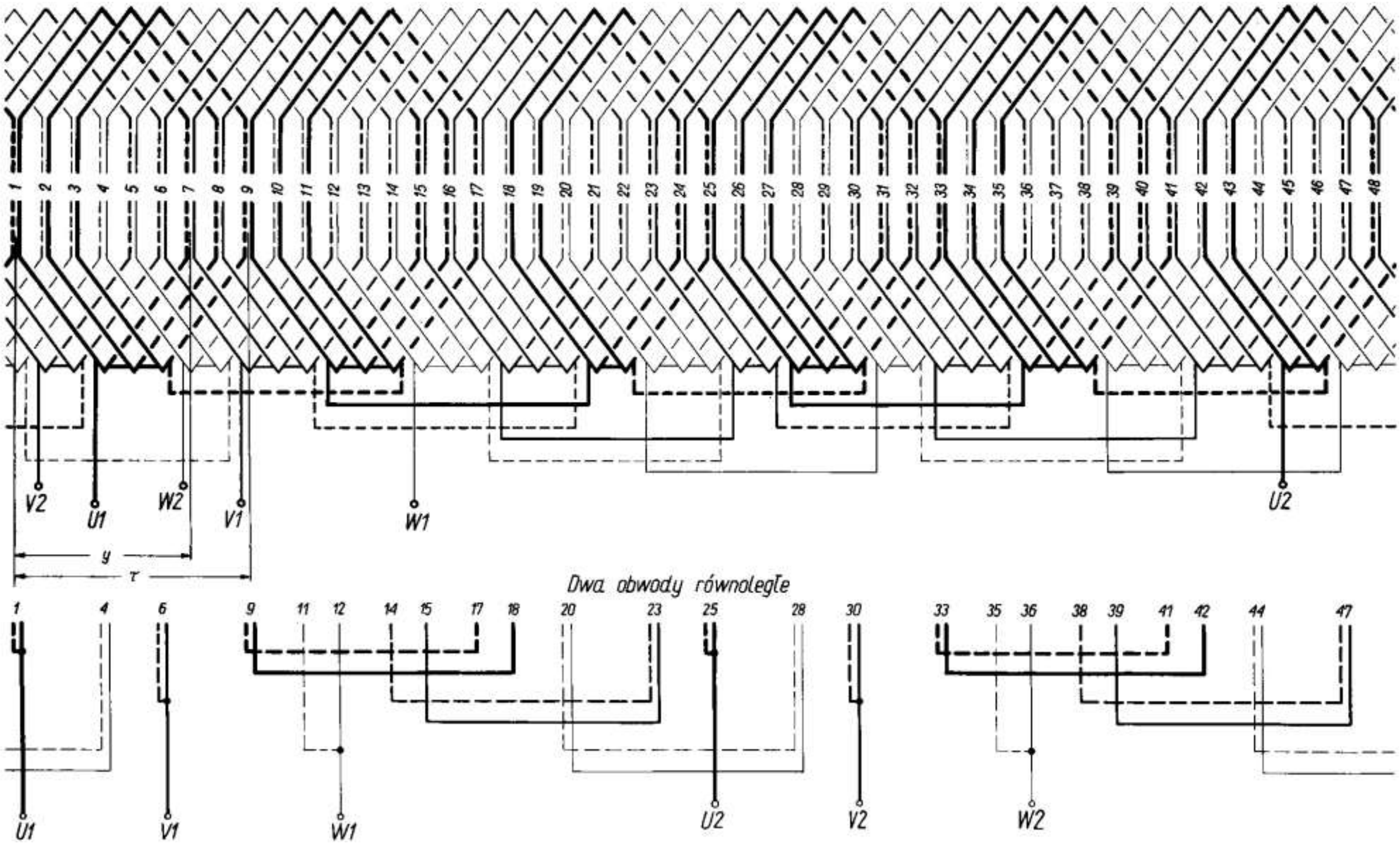


Figure. 85. Double-Layer Lap Winding with odd groups (asymmetrical Winding, rarely used)
Slots = 48; Poles = 6; y = 6; $q = 2\,{}^{2}/_{3}$

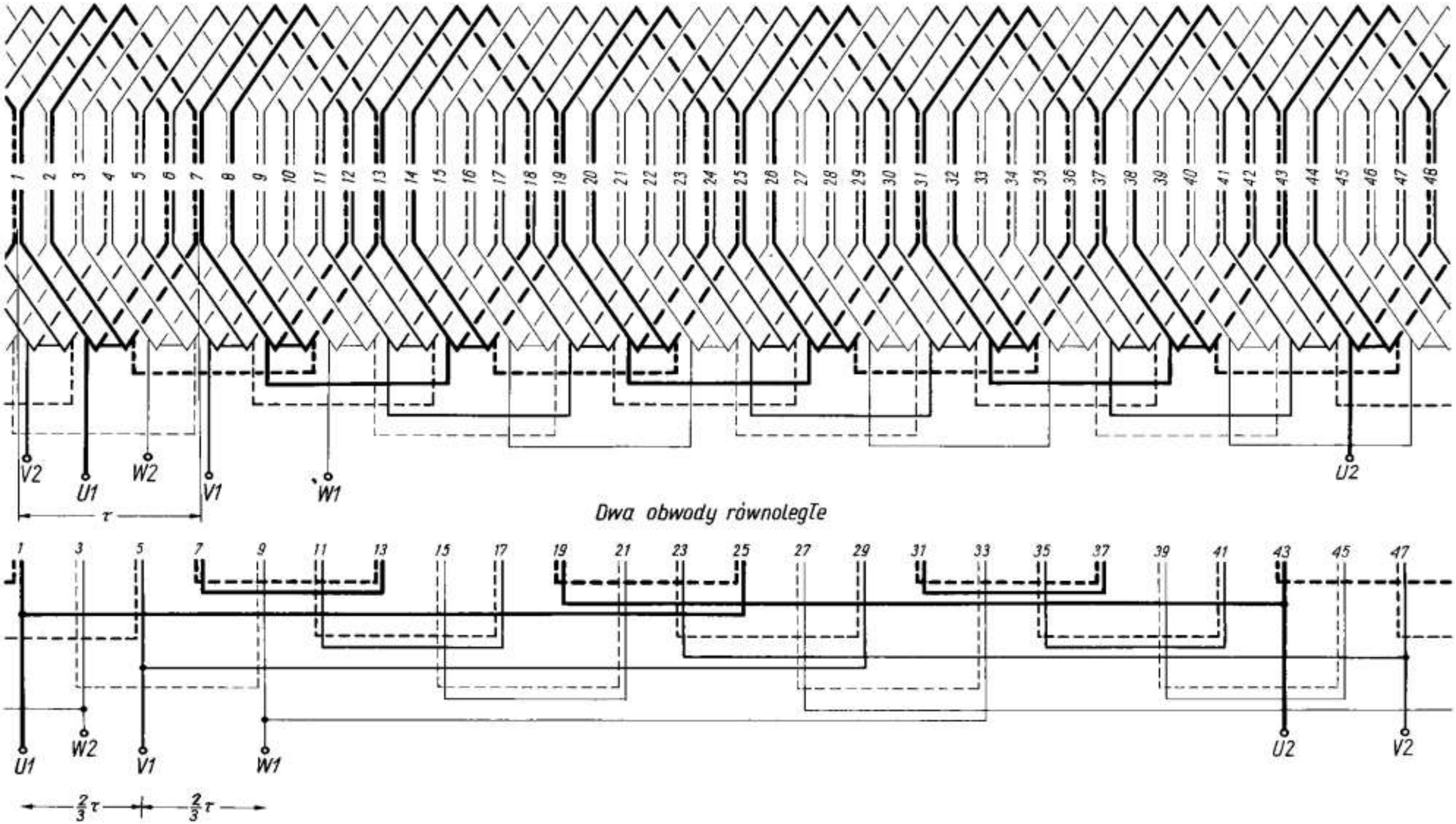
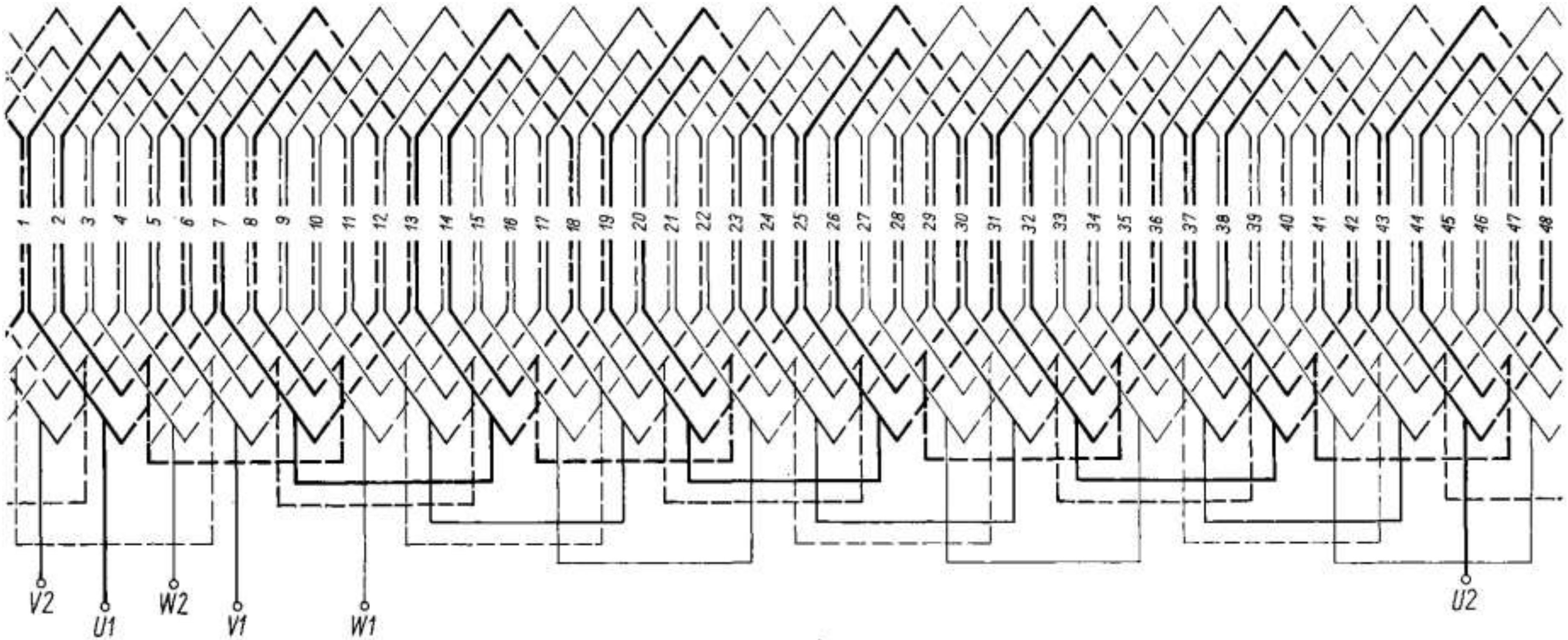


Figure. 86. Double Layer Lap Winding
Slots = 48; Poles = 8; y = 5; q = 2



Dwa obwody równoległe

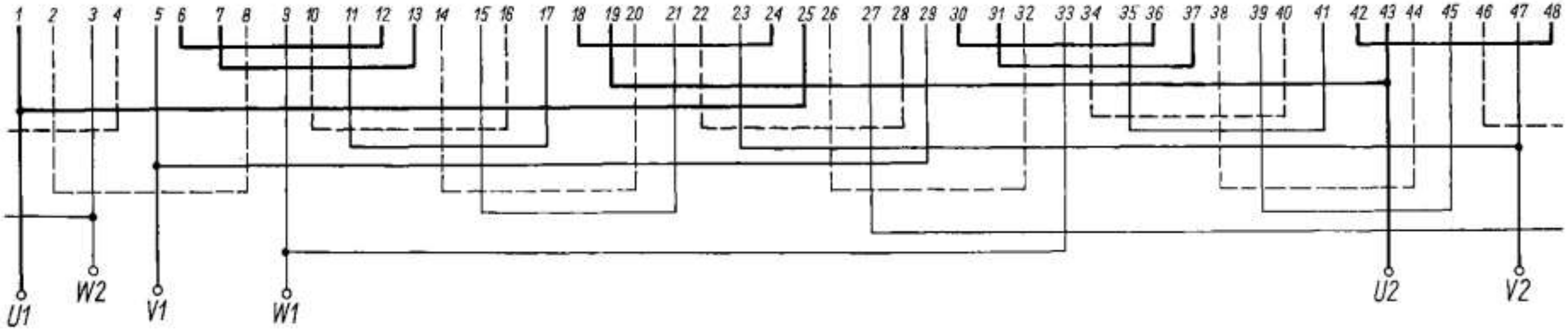
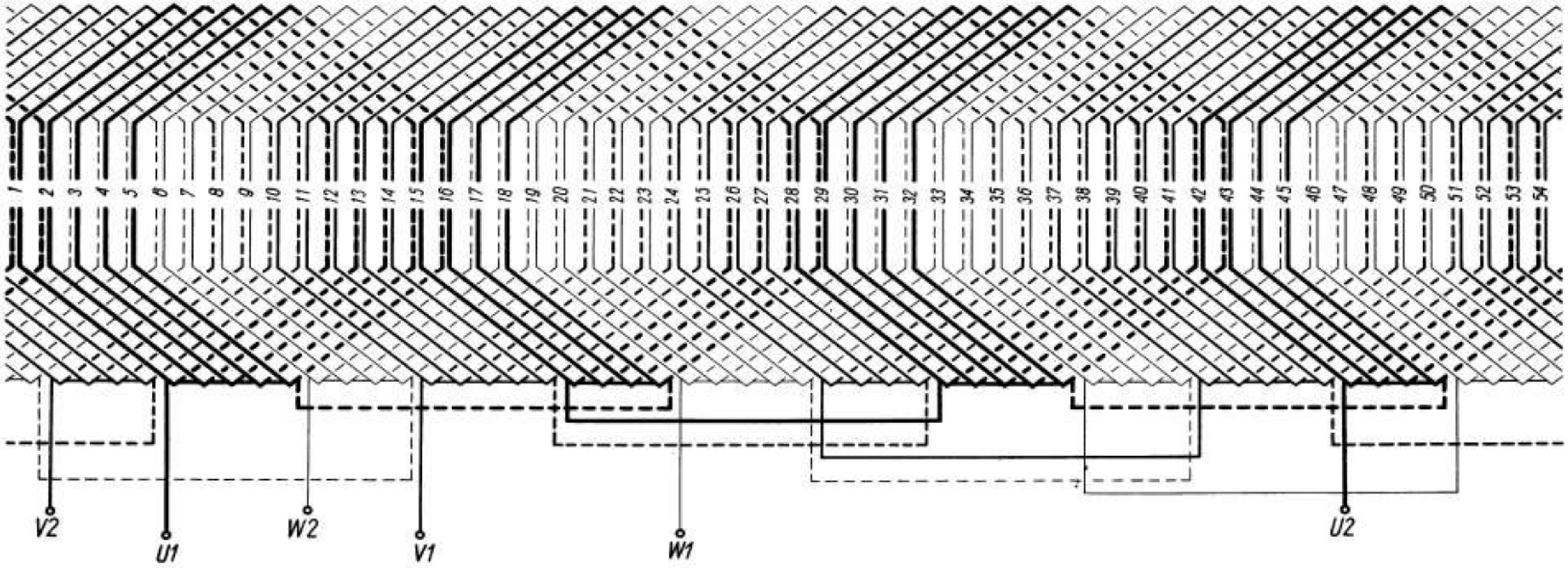


Figure. 86a. Concentric Double - Layer Winding
Slots= 48; Poles = 8; y = 4, 6; q = 2



Dwa obwody równoległe

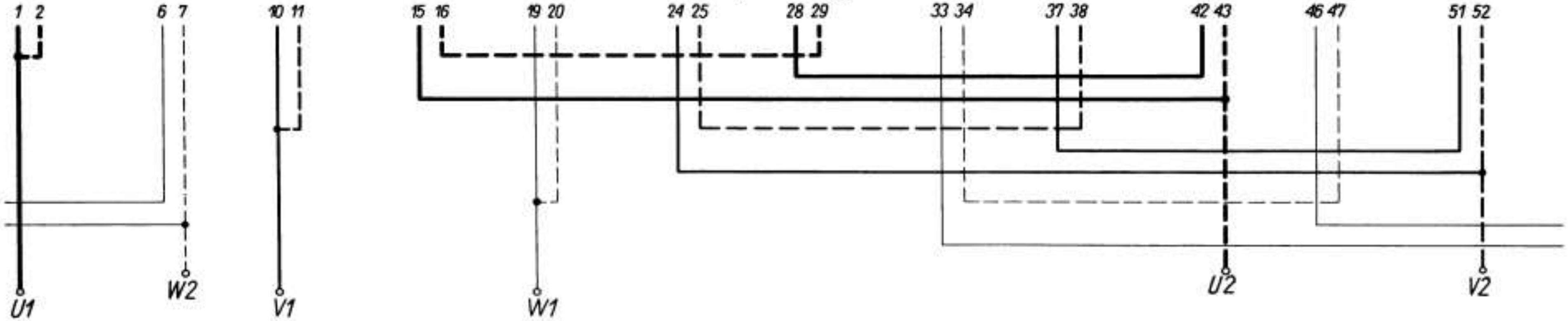
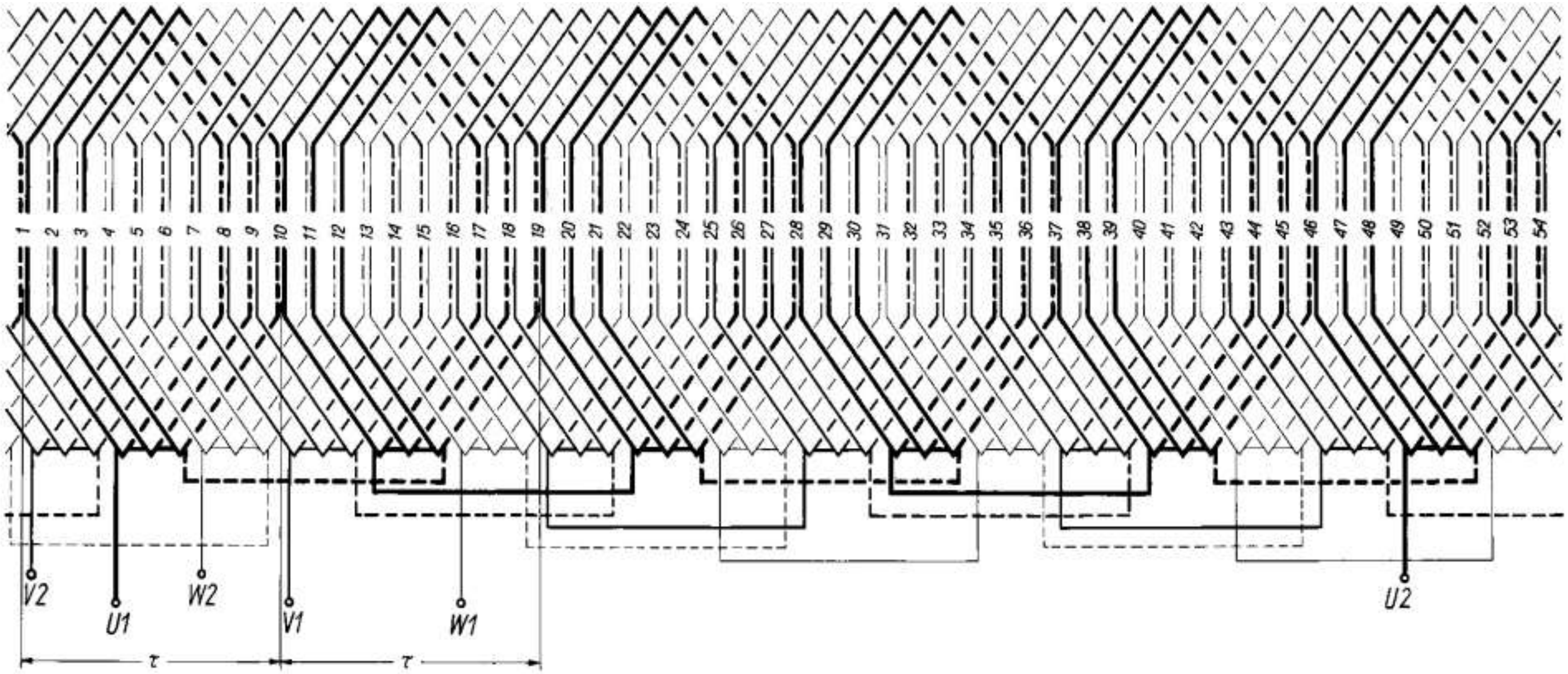


Figure. 87. Double Layer Lap Winding with odd Groups
Slots = 54; Poles = 4; y = 11; $q = 4\,{}^{1}/_{2}$



Trzy obwody równoległe

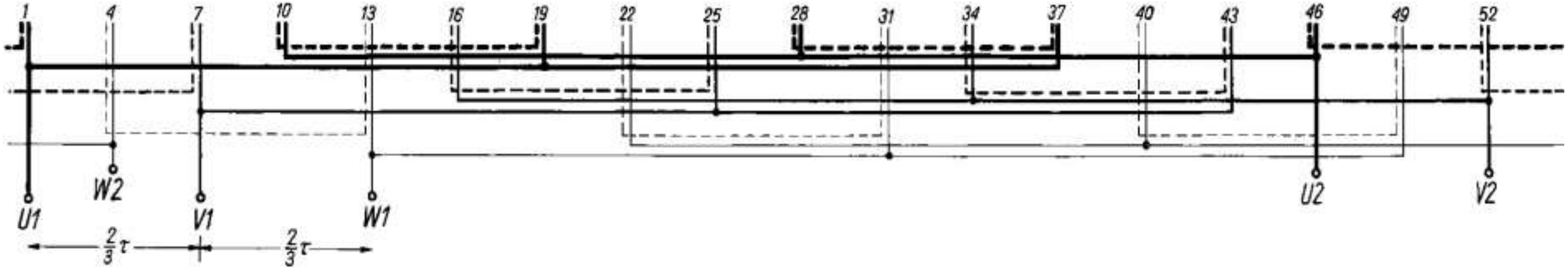
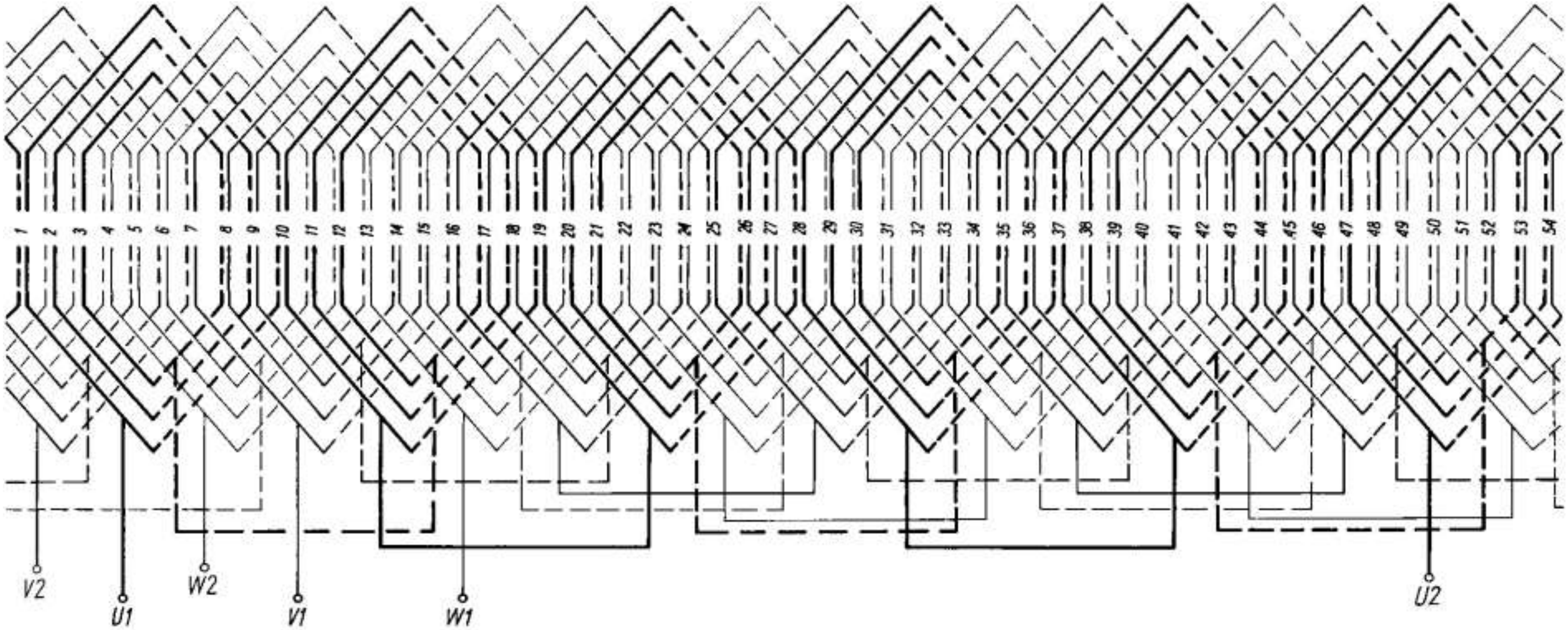


Figure. 88. Double Layer Lap Winding
Slots = 54; Poles = 6; y = 7; q = 3



Trzy obwody równoległe

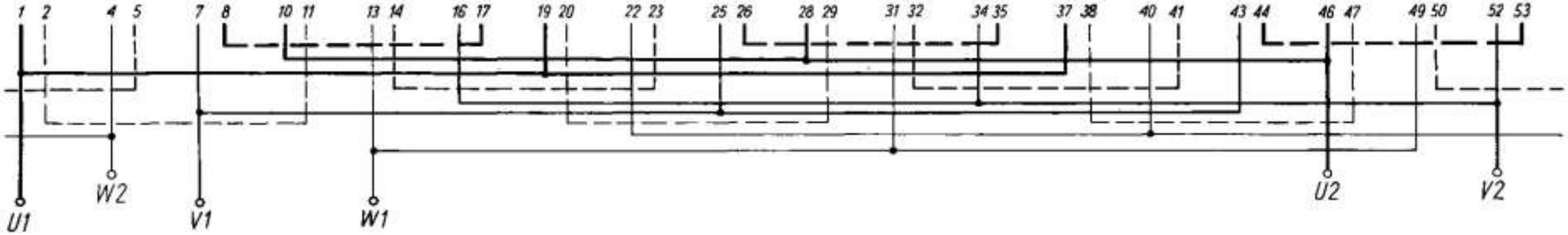
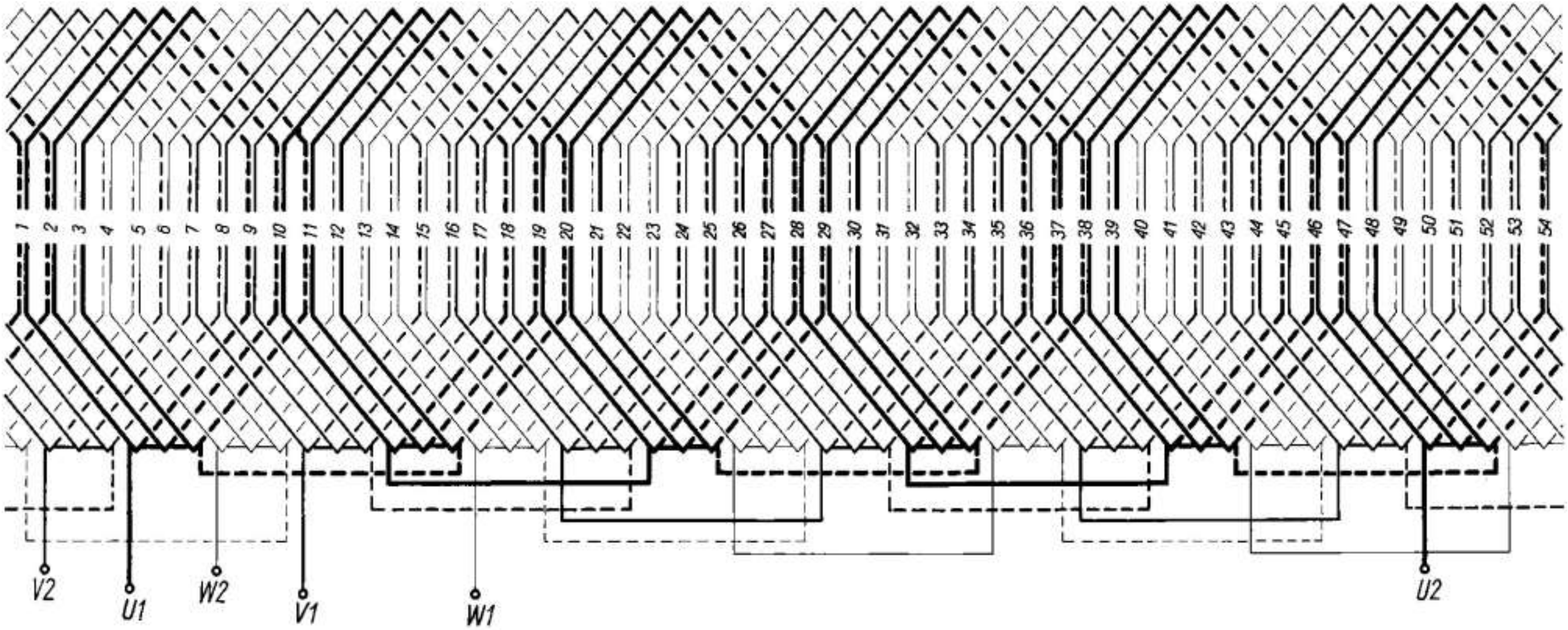


Figure. 88a. Concentric Double - Layer Winding
Slots = 54; Poles = 6; y = 5, 7, 9; q = 3



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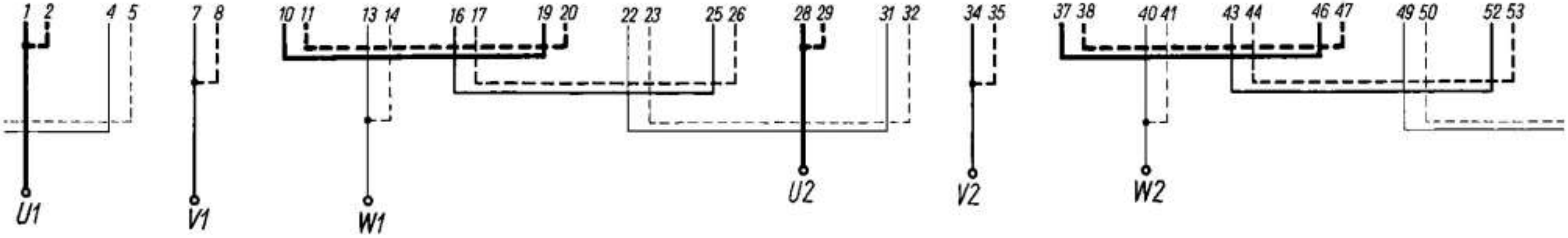
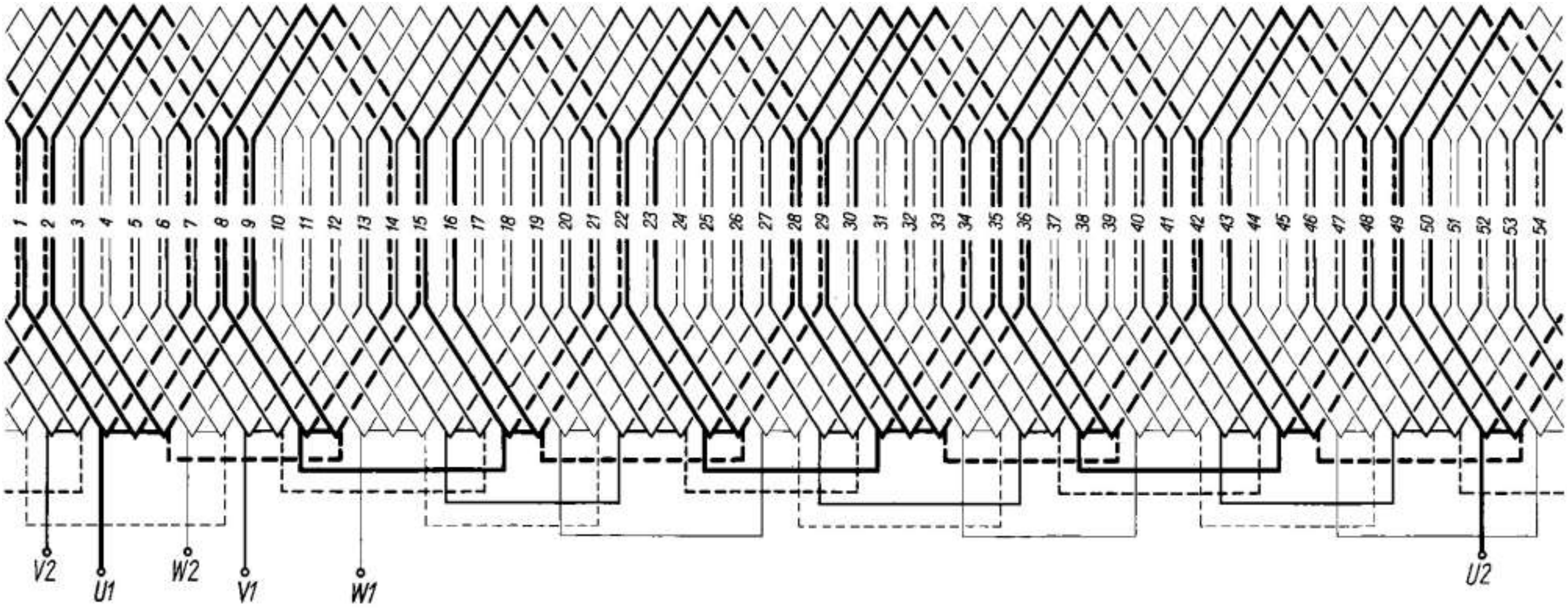


Figure. 89. Double Layer lap Winding
Slots= 54; Poles = 6; y = 8; q =



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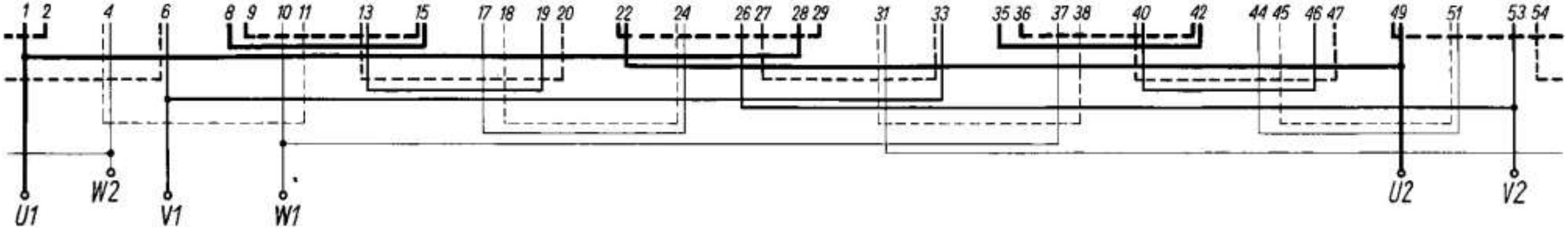


Figure. 90. Double Layer Lap Winding with odd Groups
Slots = 54; Poles = 8; $y = 6$; $q = 2\,{}^{1}/_{4}$

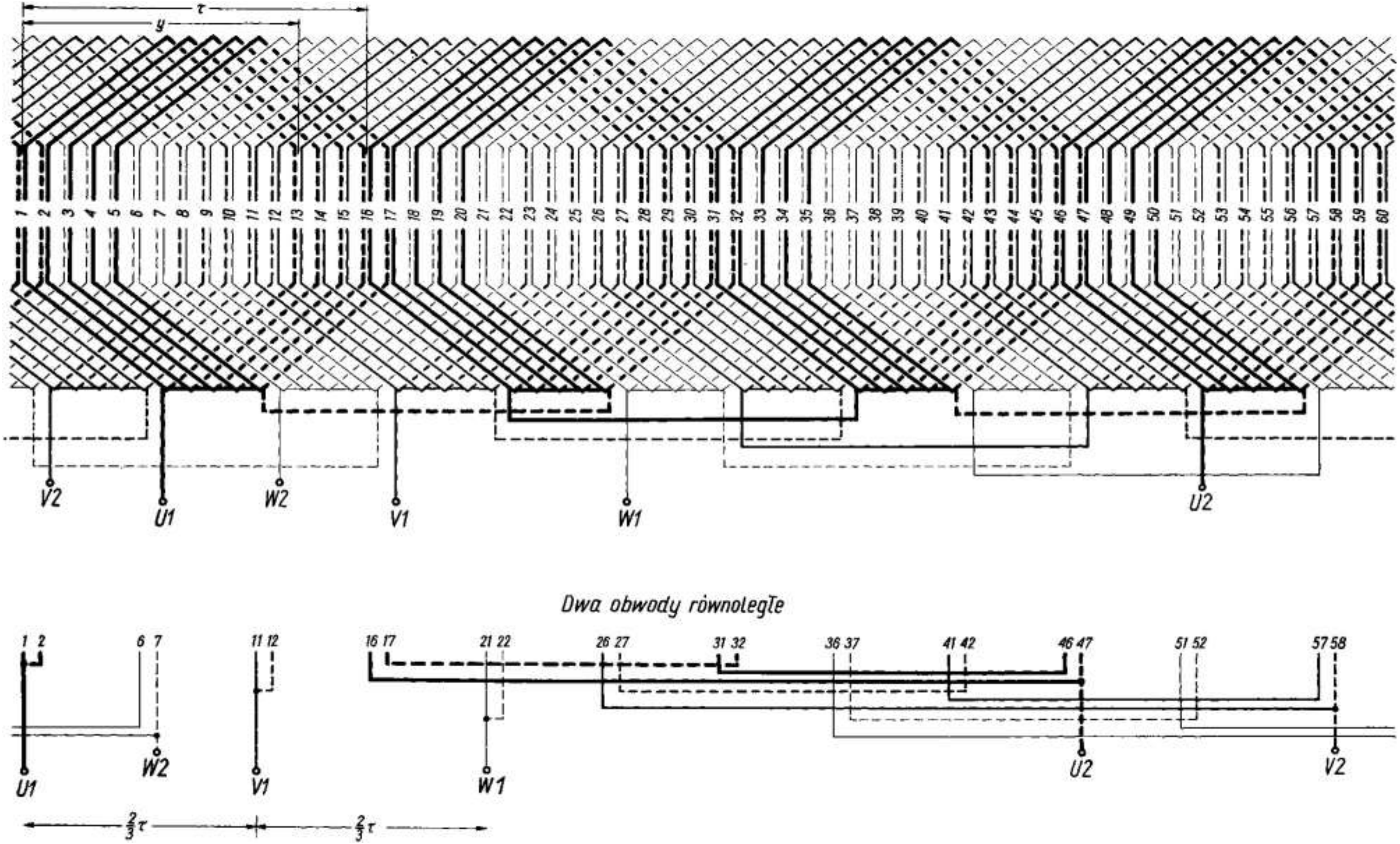


Figure. 91. Double Layer Lap Winding
Slots = 60; Poles = 4; y = 12; q = 5

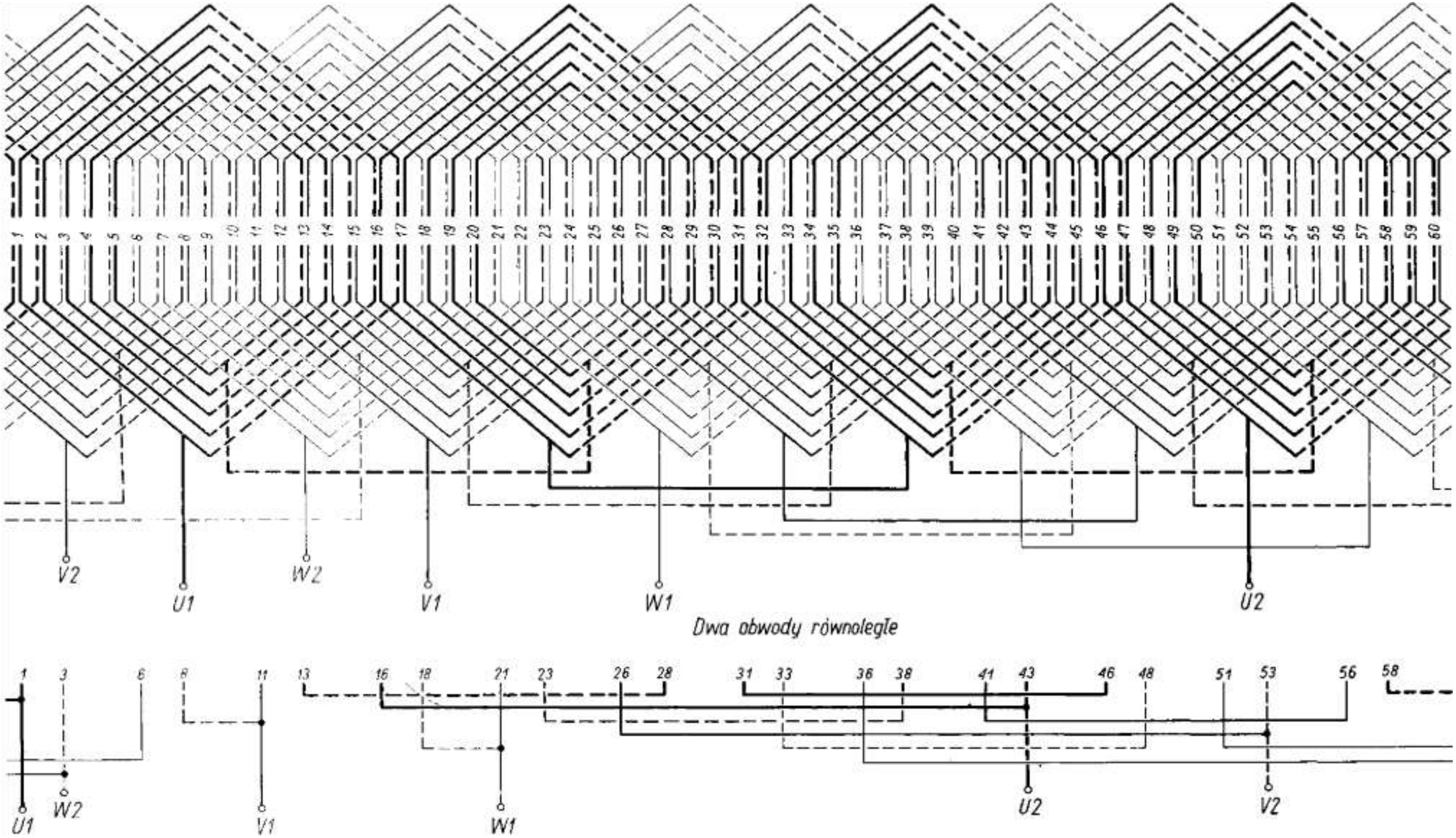
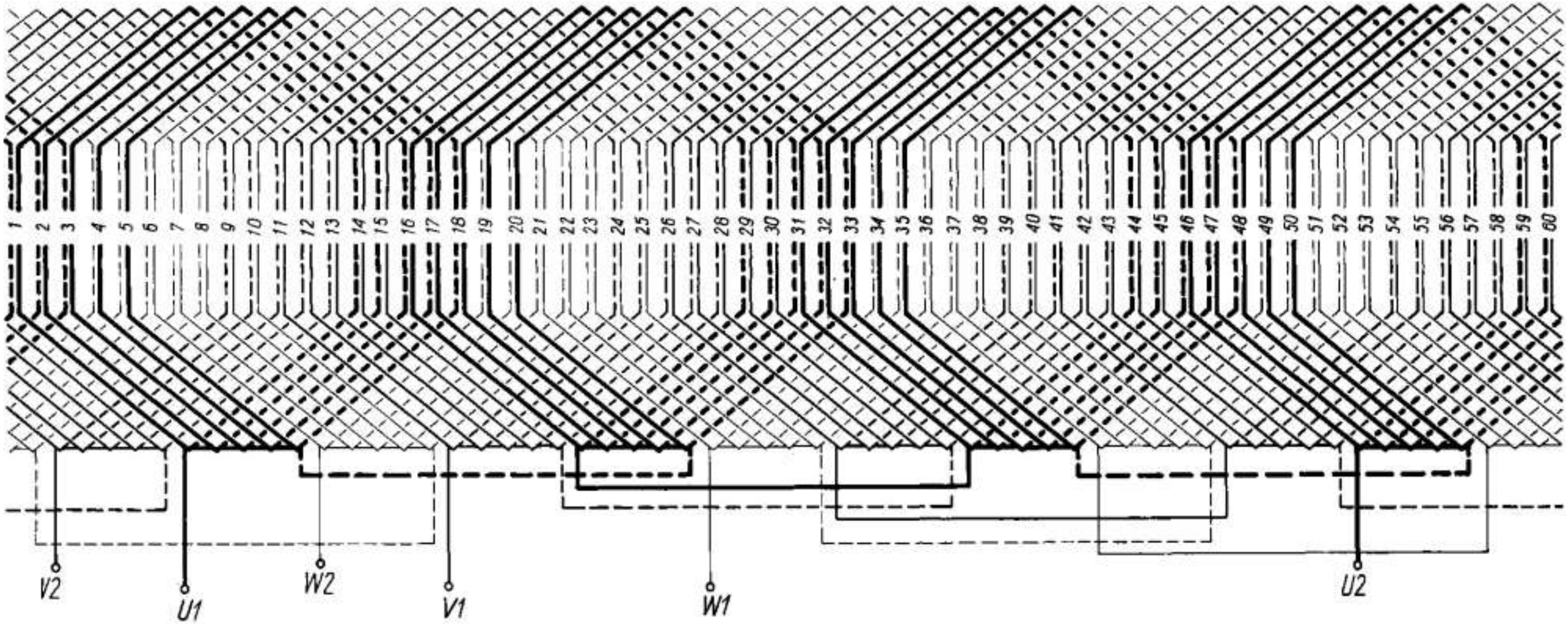


Figure. 91a. Concentric Double - Layer Winding
Slots = 60; Poles = 4; y = 8, 10, 12, 14, 16; q = 5



Cztery obwody równoległe

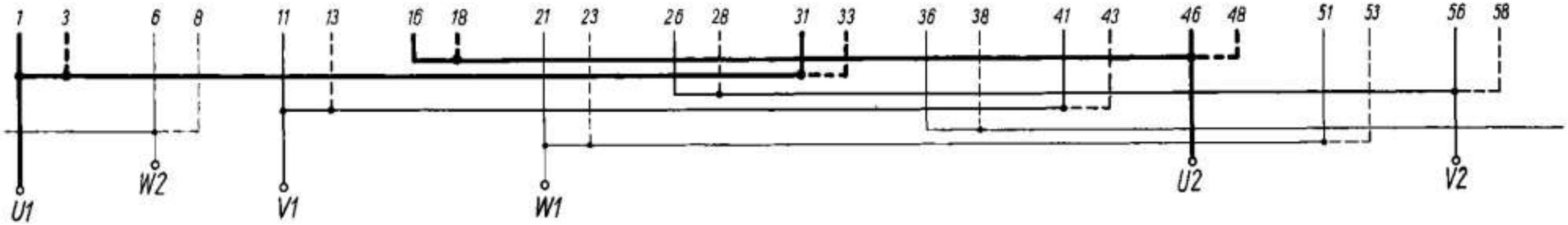
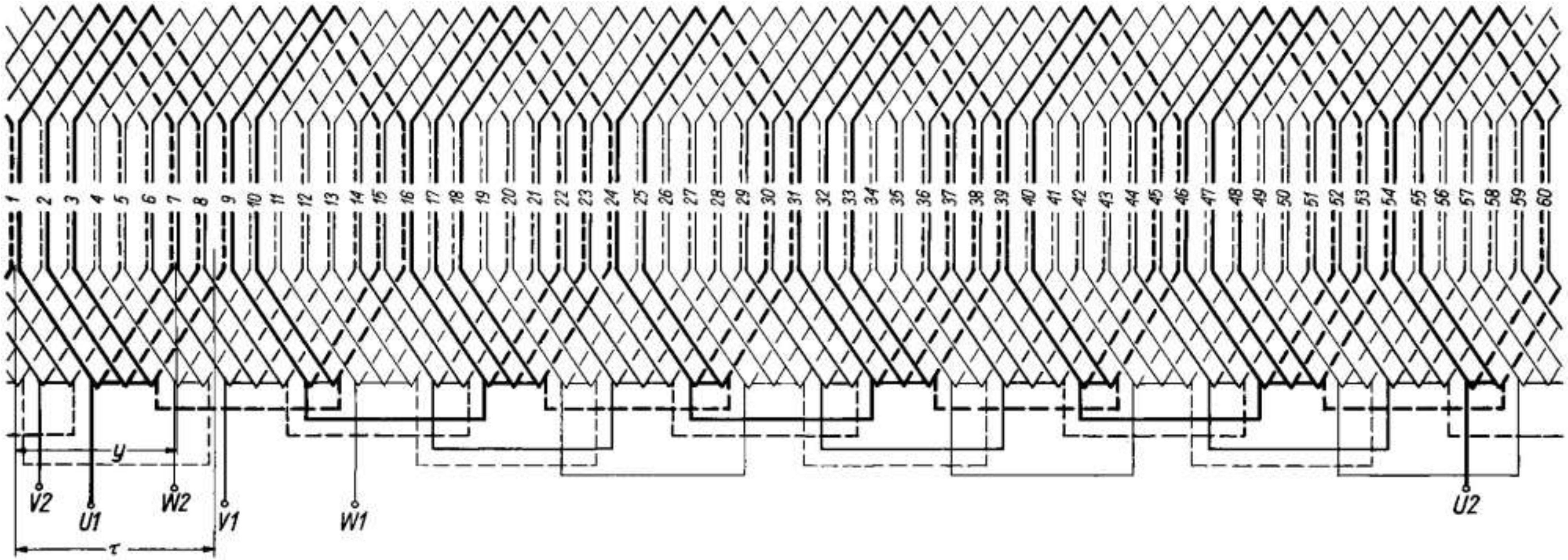


Figure. 92. Double Layer Lap Winding
Slots = 60; Poles = 4; y = 13; q = 5



Dwa obwody równoległe

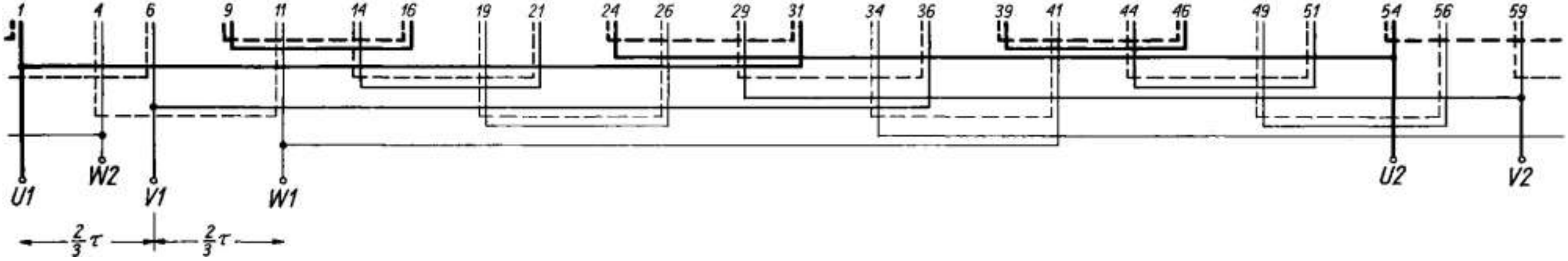
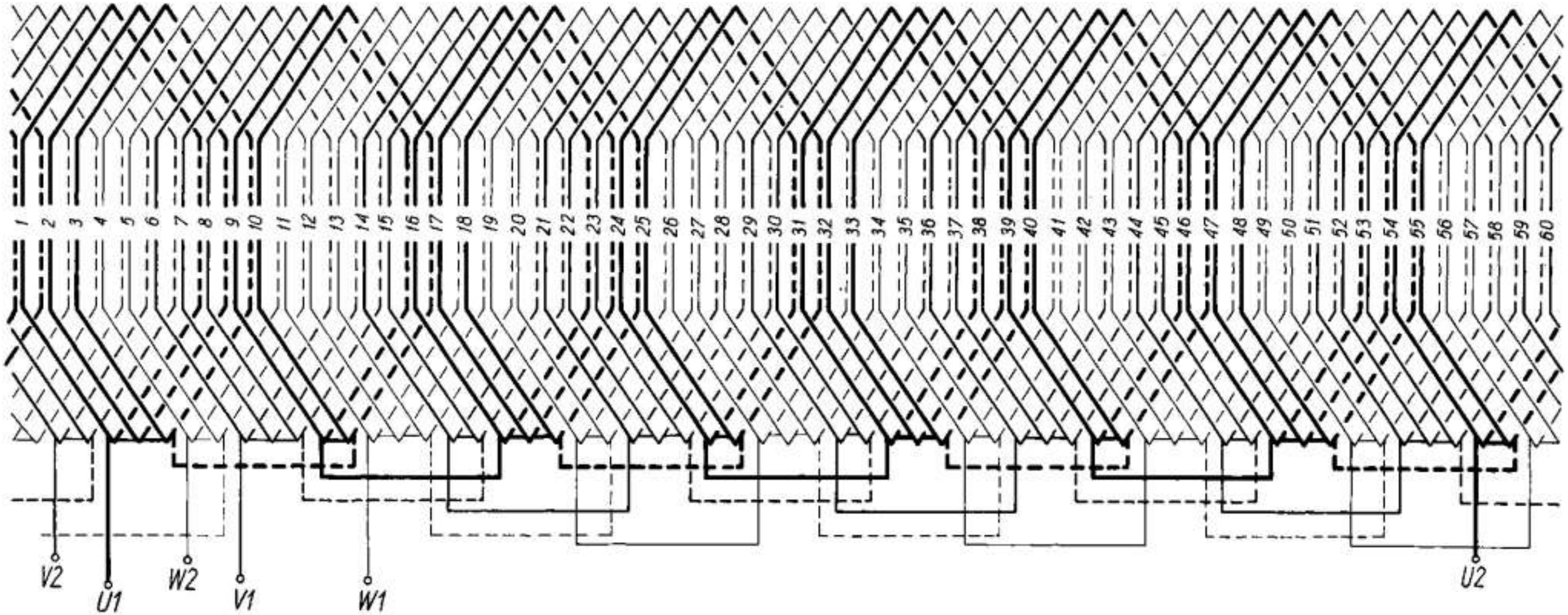


Figure. 93. Double Layer Lap Winding with odd Groups
Slots = 60; Poles = 8; y = 6; q = $1\,{}^{1}/_{2}$



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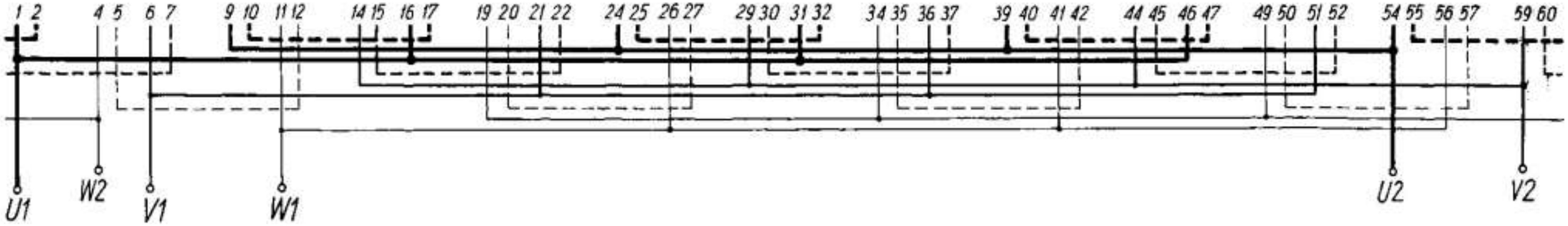


Figure. 94. Double Layer Lap Winding with odd Groups
Slots = 60; Poles = 8; y = 7; q = 2 $^1/_2$

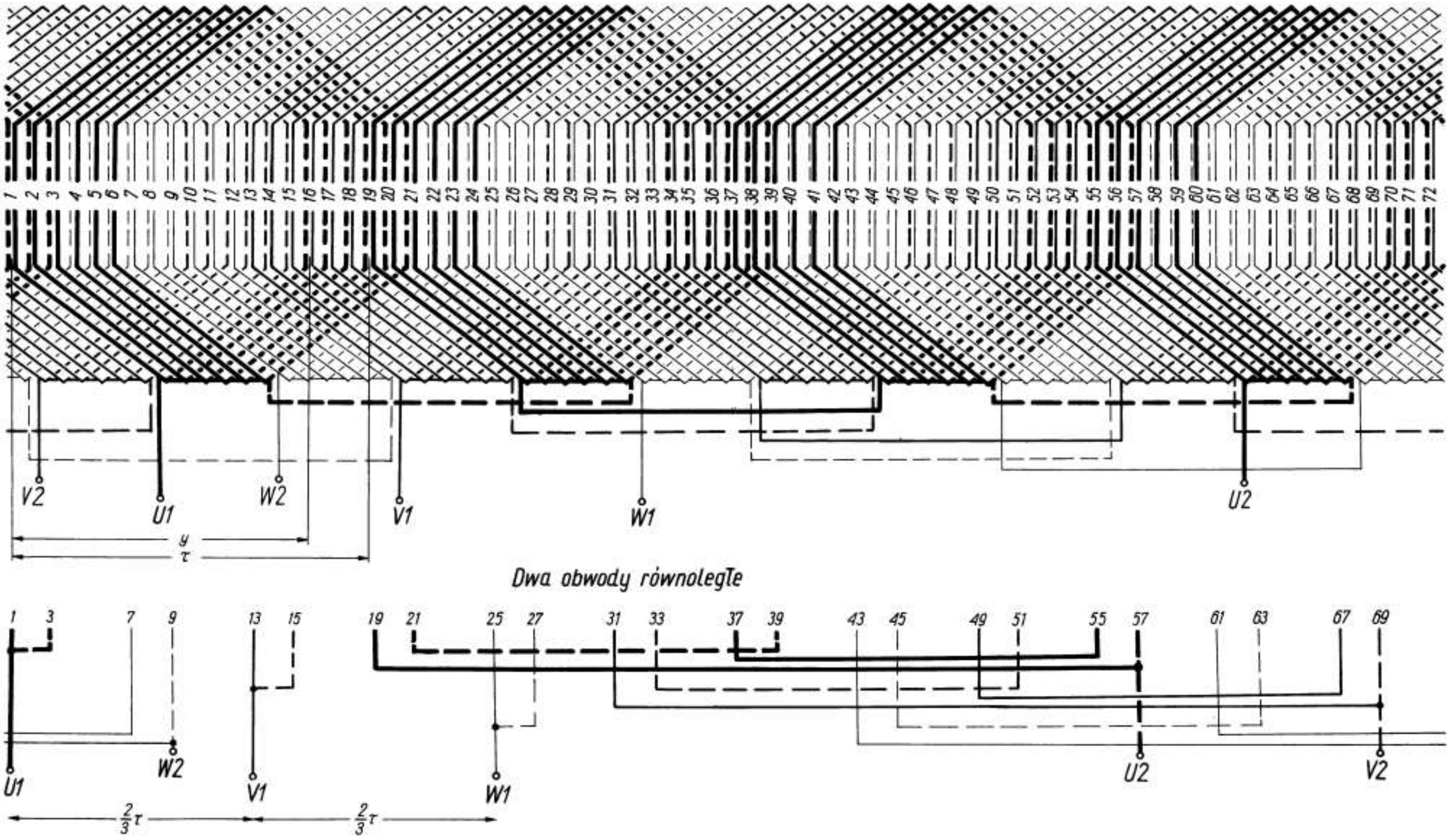
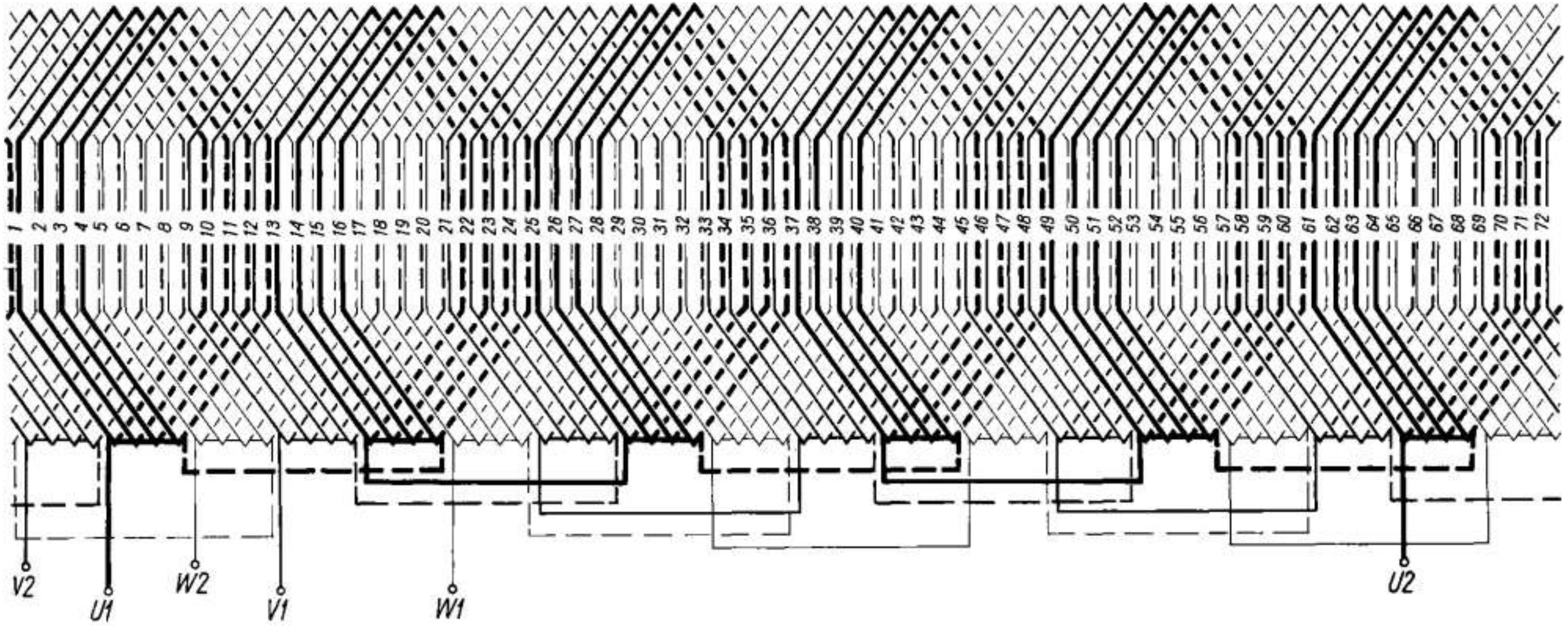


Figure. 95. Double Layer Lap Winding
Slots= 72; Poles = 4; y = 15; q = 6



Trzy obwody równoległe

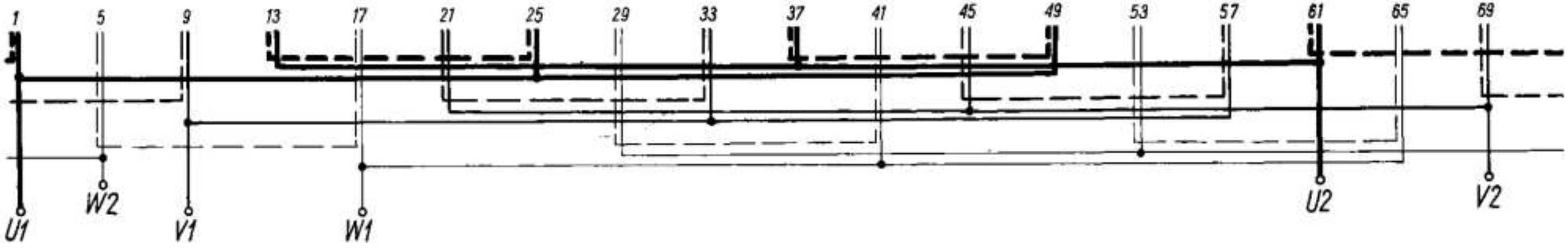


Figure. 96. Double Layer Lap Winding
Slots = 72; Poles = 6; y = 9; q = 4

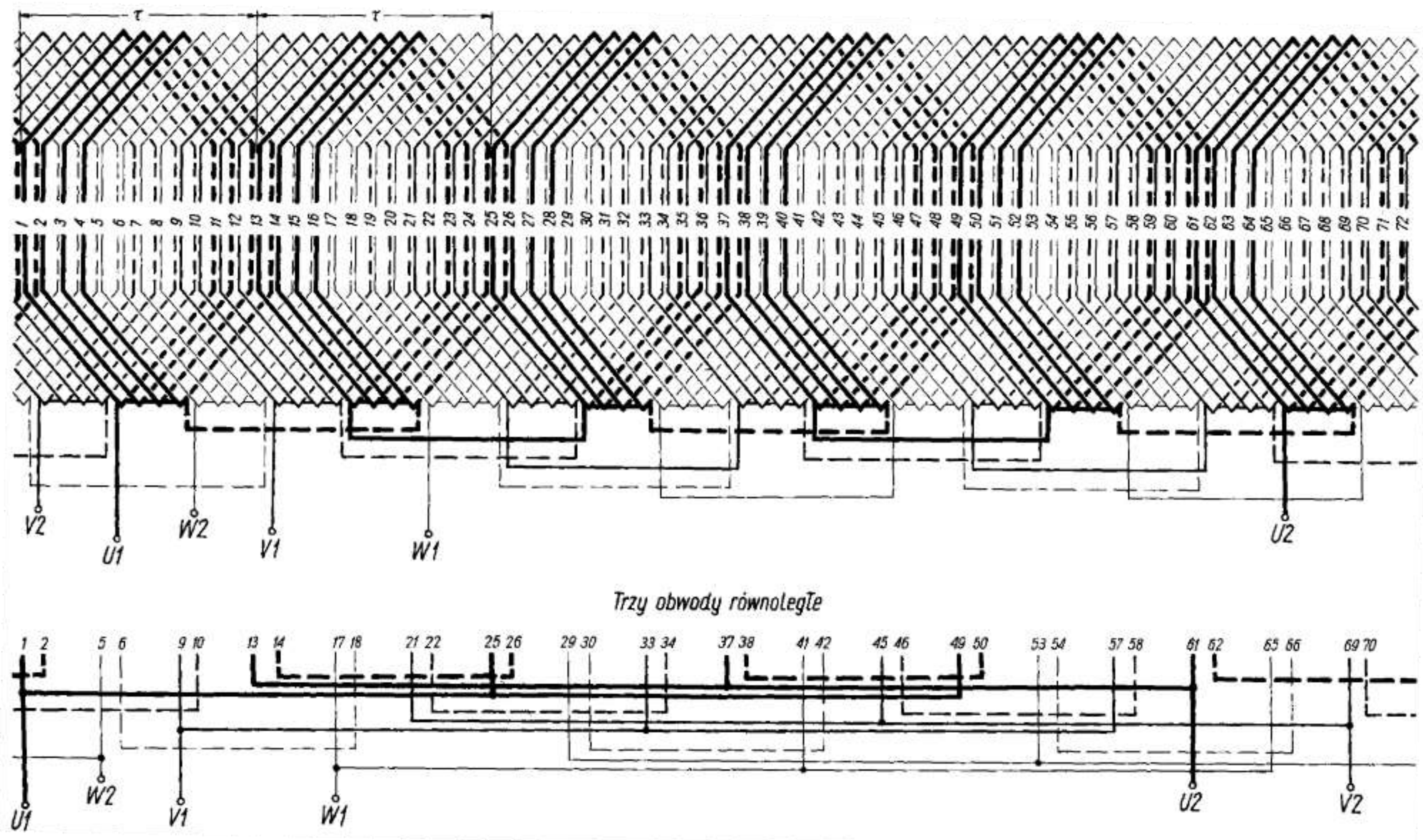
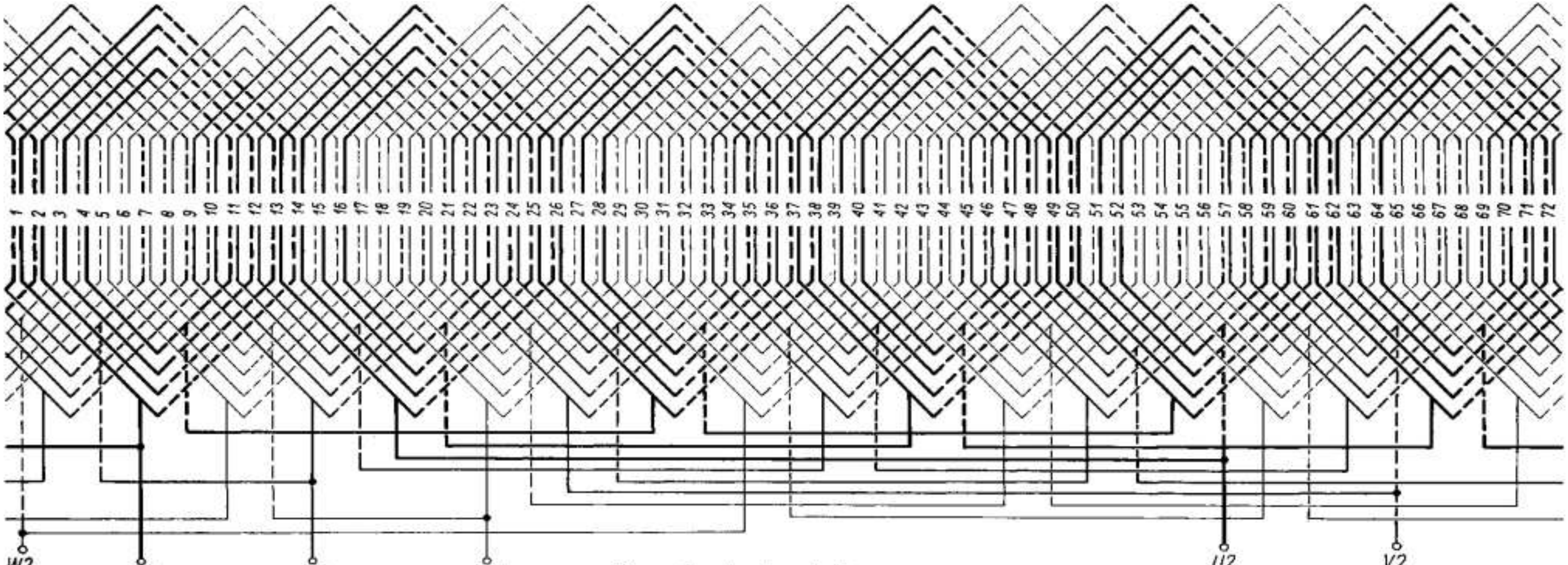
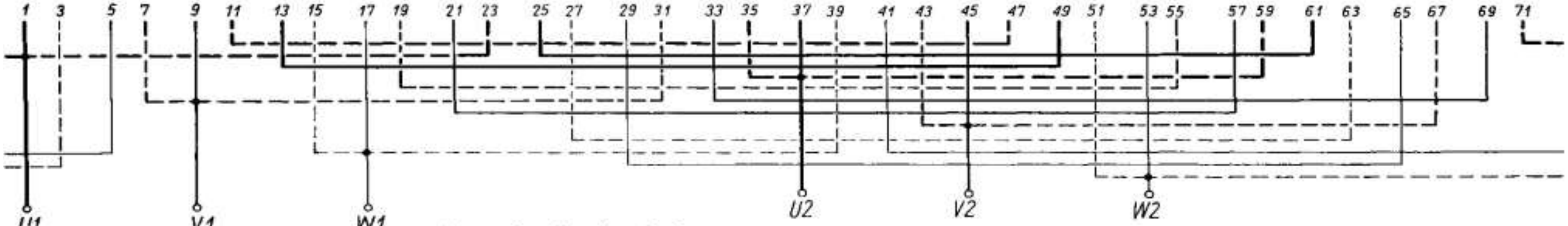


Figure. 97. Double Layer Lap Winding
Slots = 72; Poles = 6; $y = 10$; $q = 4$

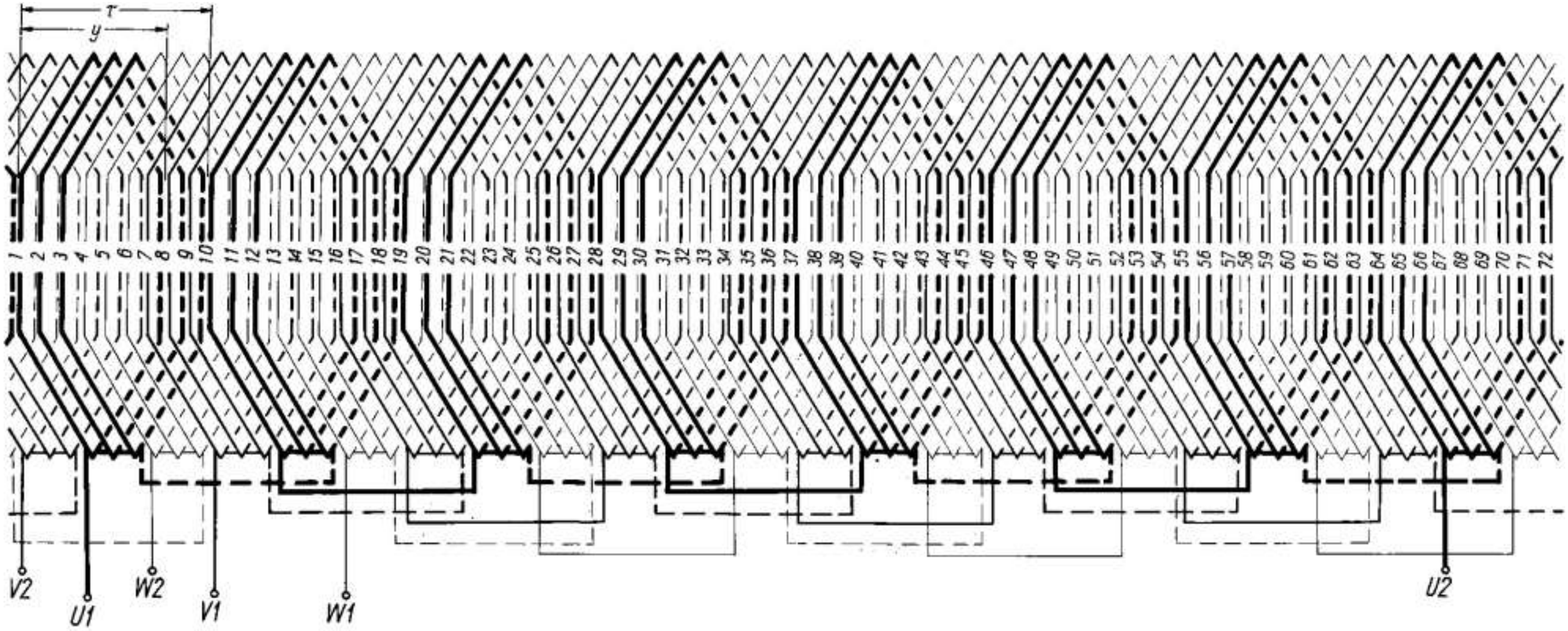


Dwa obwody równoległe



Trzy obwody równoległe

Figure. 97a. Concentric Double - Layer Winding
Slots = 72; Poles = 6; y = 7, 9, 11, 13; q = 4



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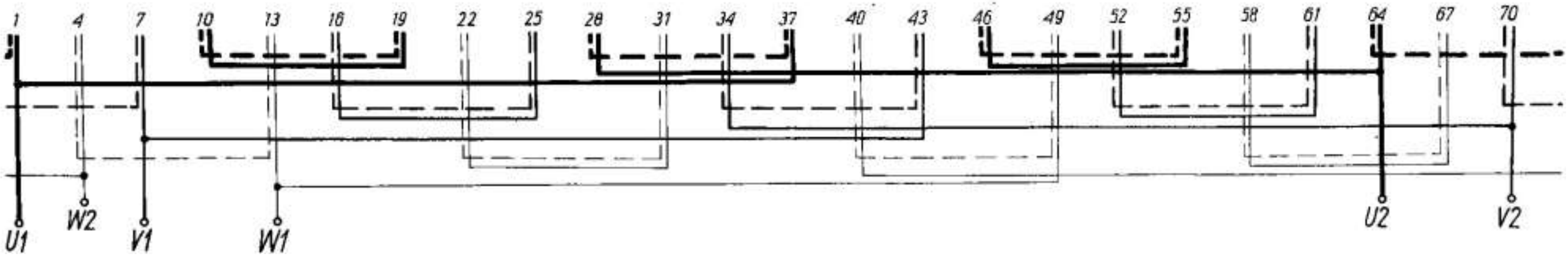
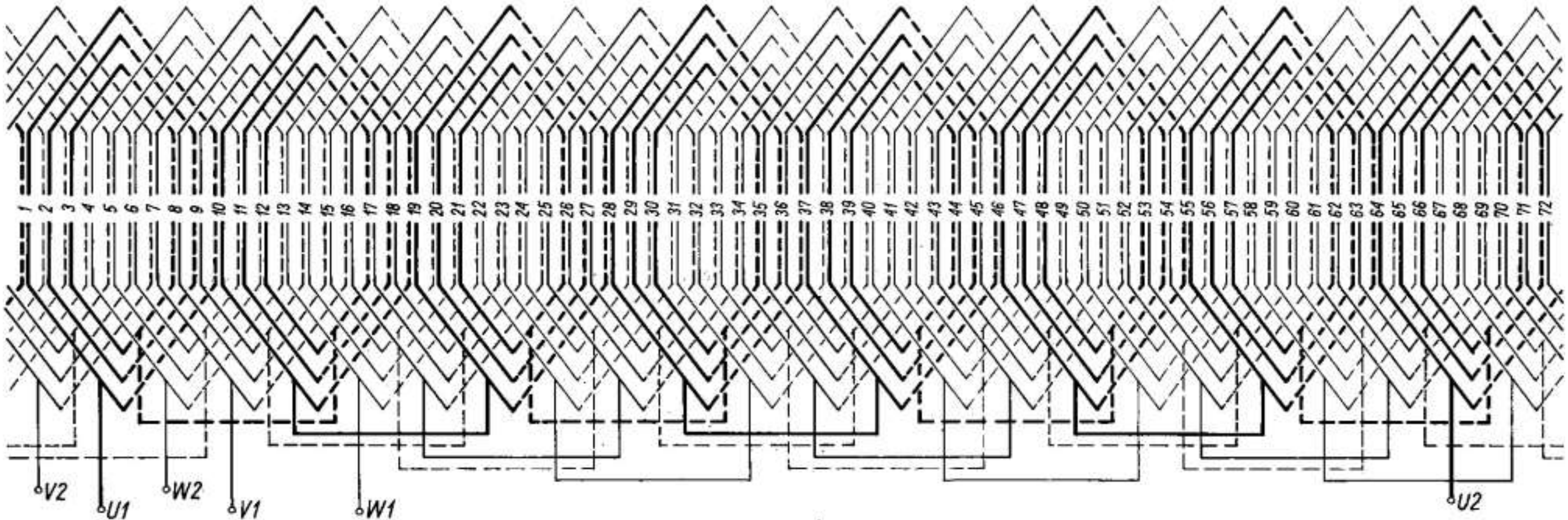


Figure. 98. Double Layer Lap Winding
Slots = 72; Poles = 8; y = 7; q = 3



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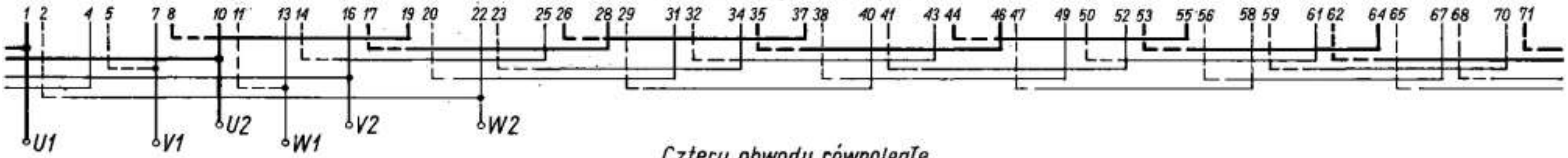

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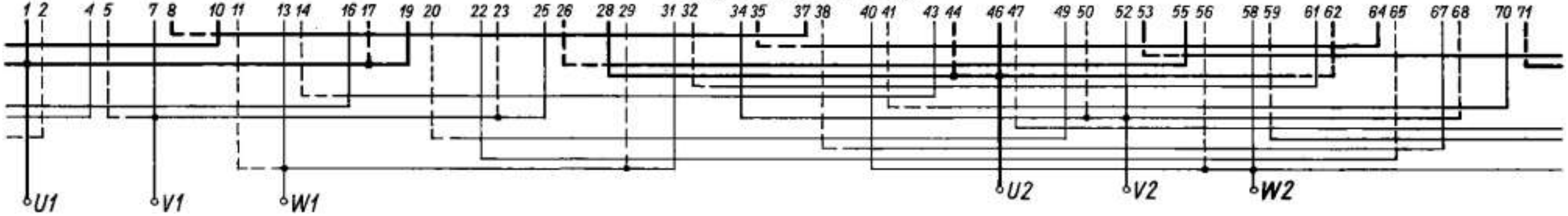
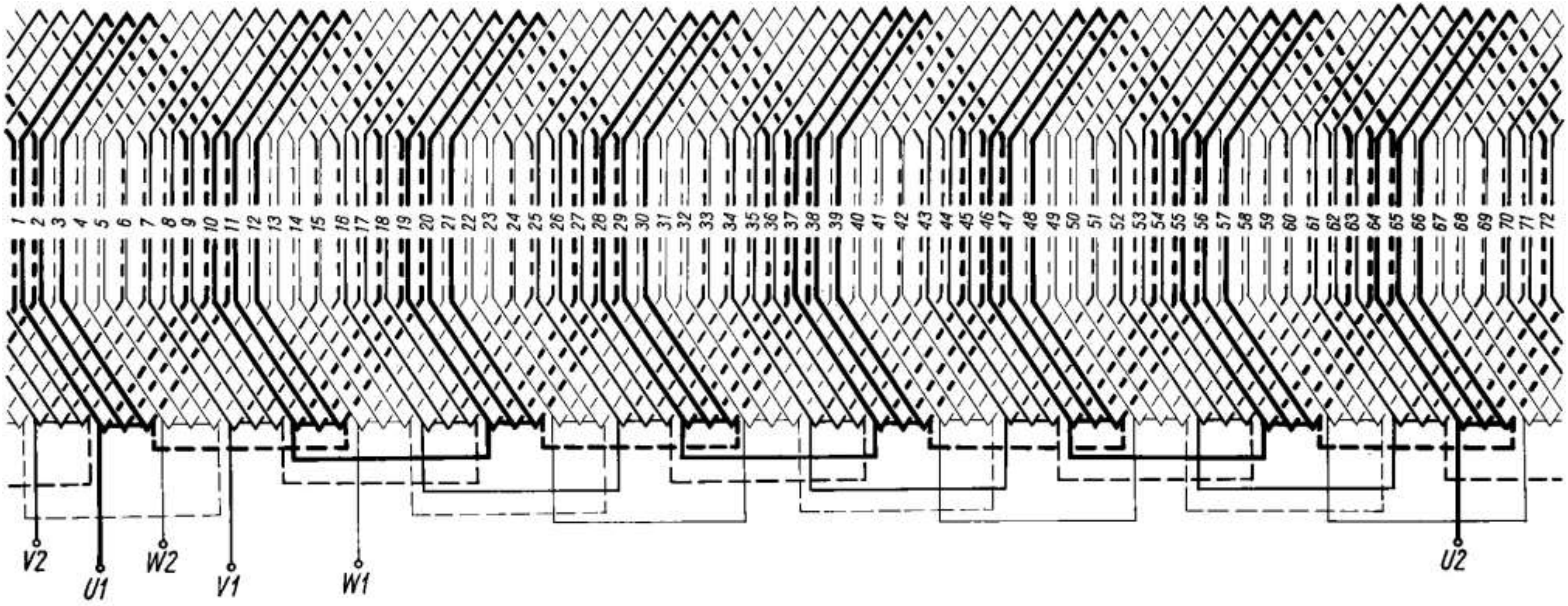


Figure. 98a. Concentric Double - Layer Winding
Slots = 72; Poles = 8; y = 5, 7, 9; q = 3



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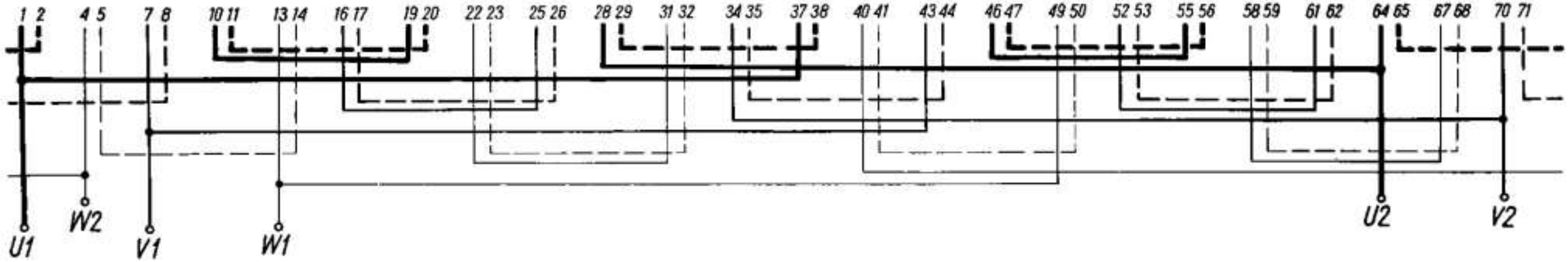
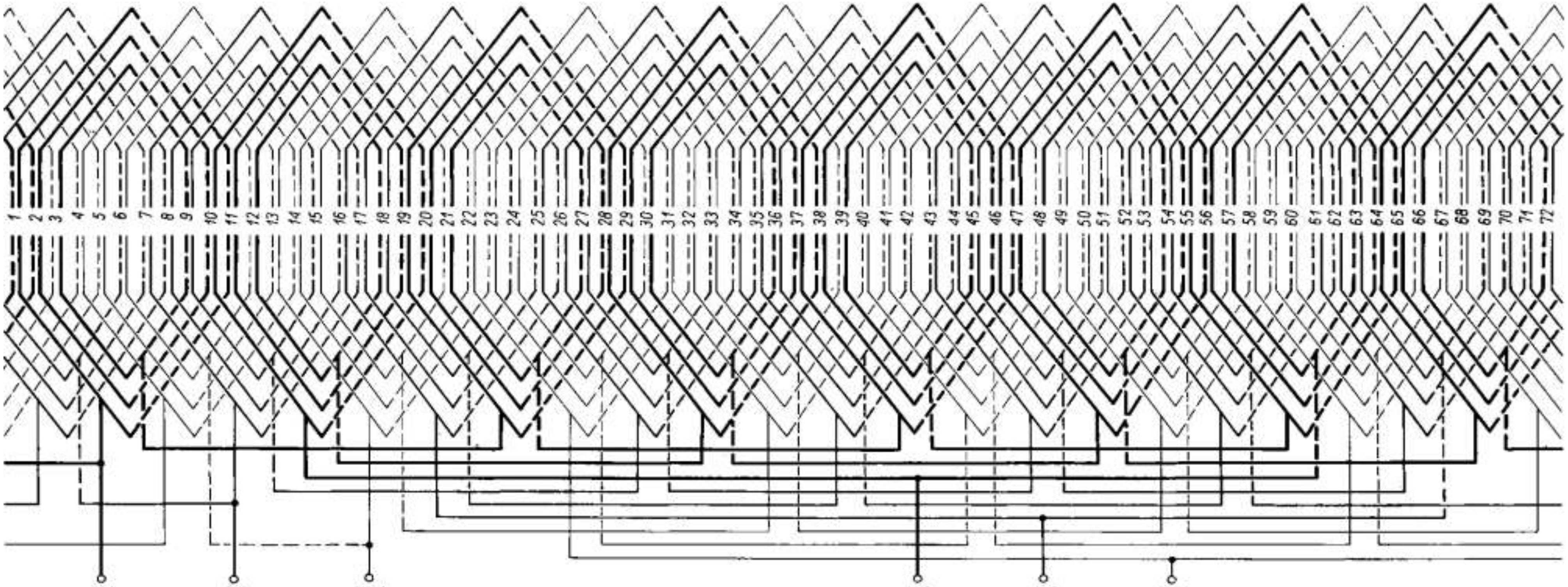


Figure. 99. Double Layer Lap Winding
Slots = 72; Poles = 8; y = 8; q = 3



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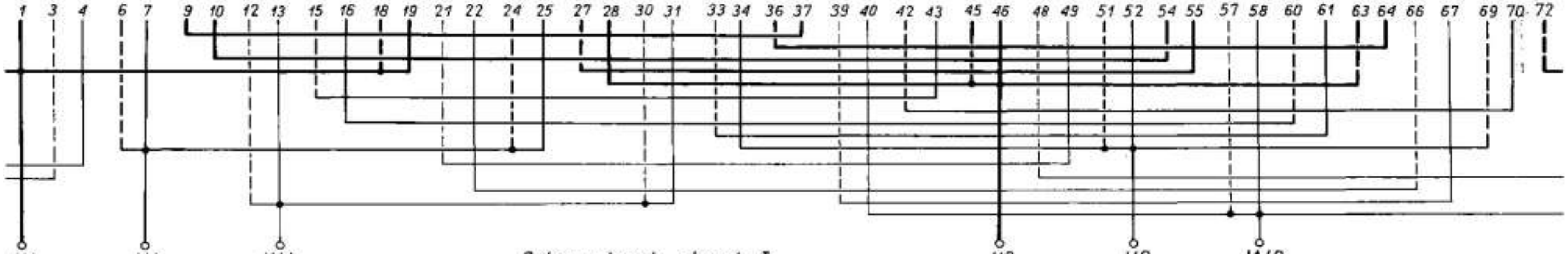


Cztery obwody równoległe

Figure. 99a. Concentric Double - Layer Winding
Slots = 72; Poles = 8; y = 6, 8, 10; q = 3

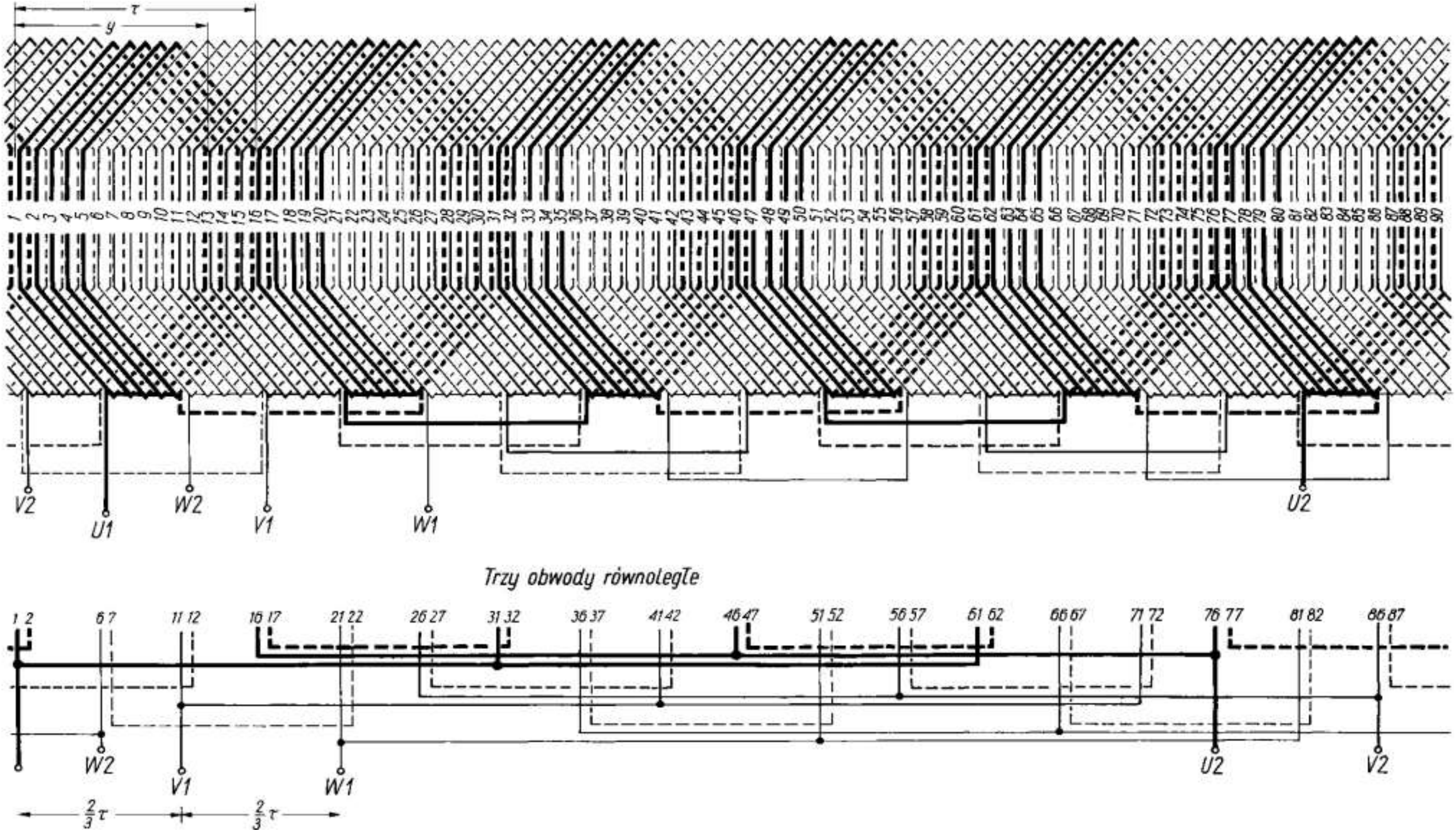
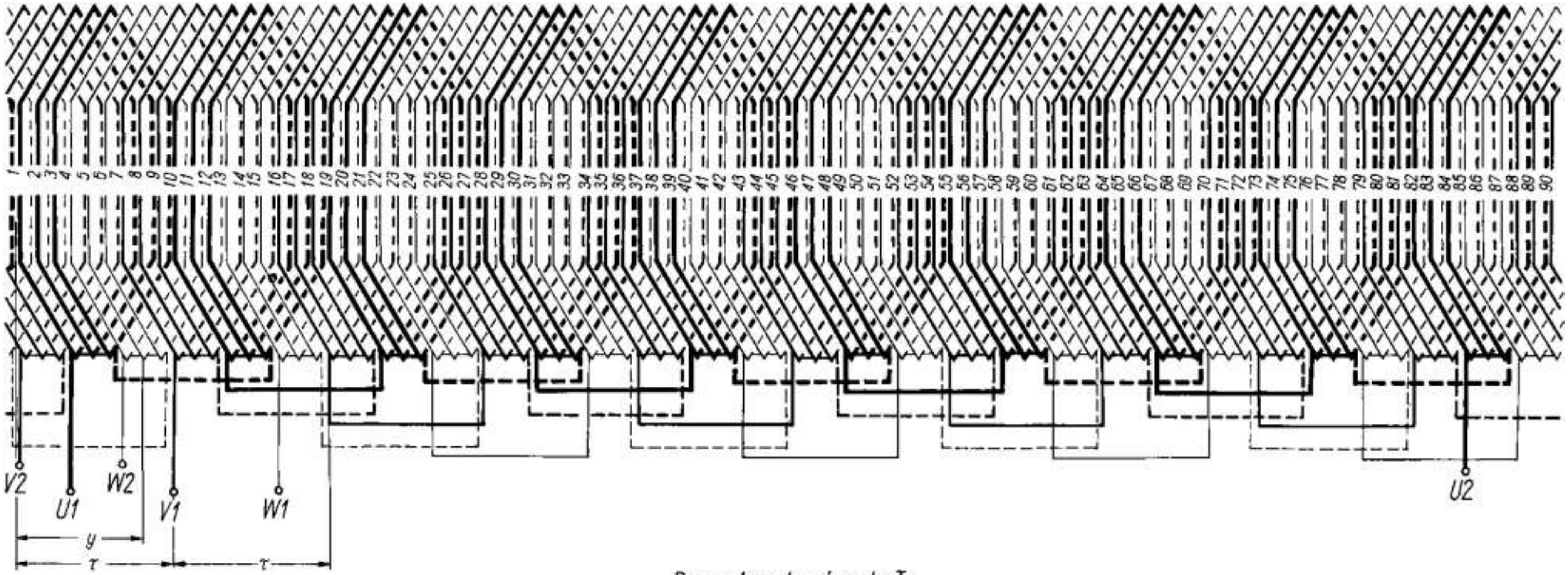


Figure. 100. Double Layer lap Winding
Slots = 90; Poles = 6; y = 12; q = 5



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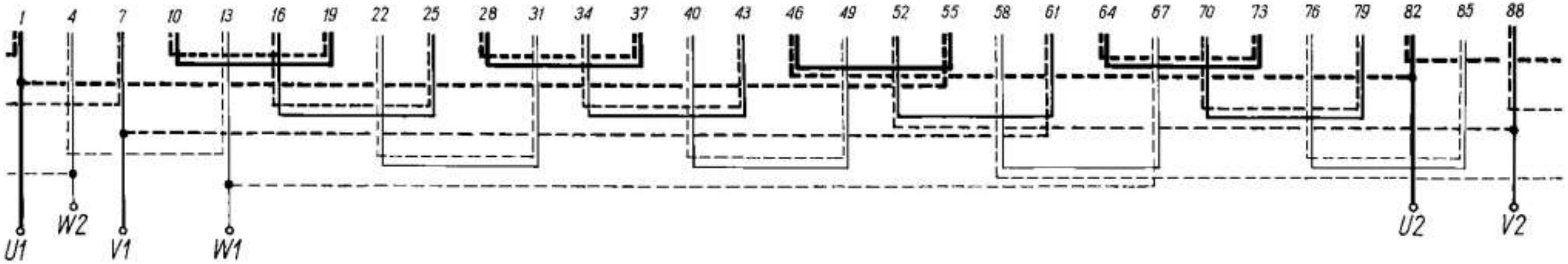


Figure. 101. Double Layer Lap Winding
Slots = 90; Poles = 10; y = 7; q = 3

Rotor Windings Lap & Wave

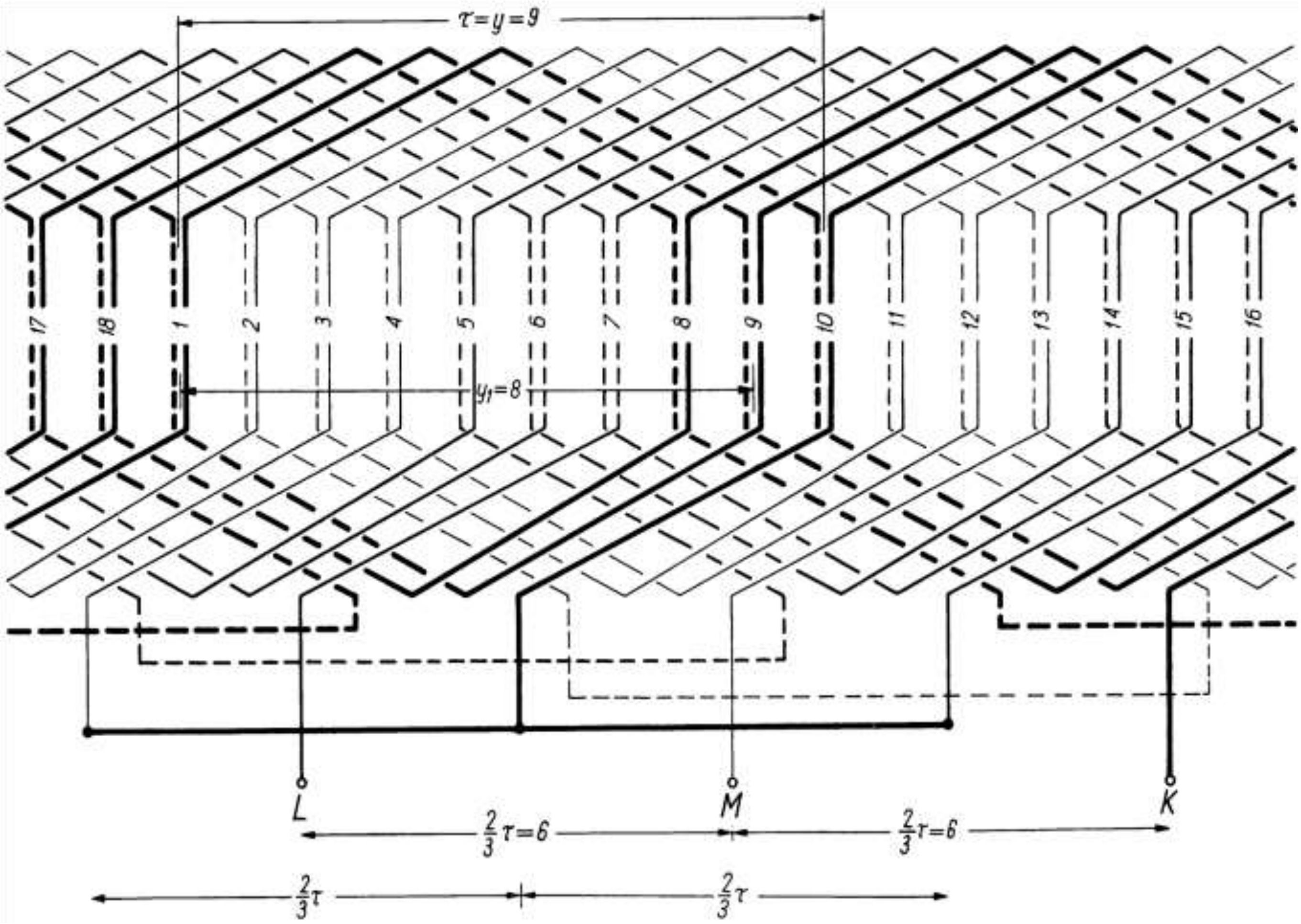


Figure. 102. Rotor Winding (Wave)
Slots = 18; Poles = 2; y = 9; q = 3

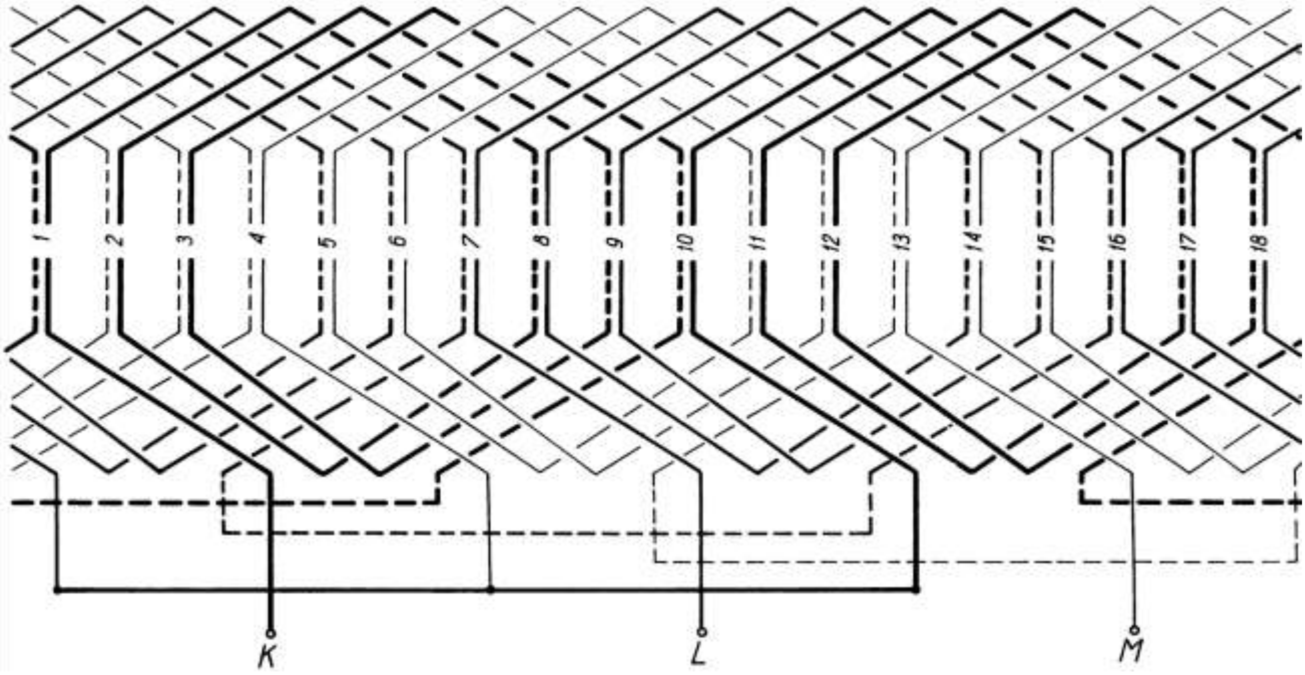


Figure. 103. Rotor Winding (Lap)
Slots = 18; Poles = 2; y = 7; q = 3

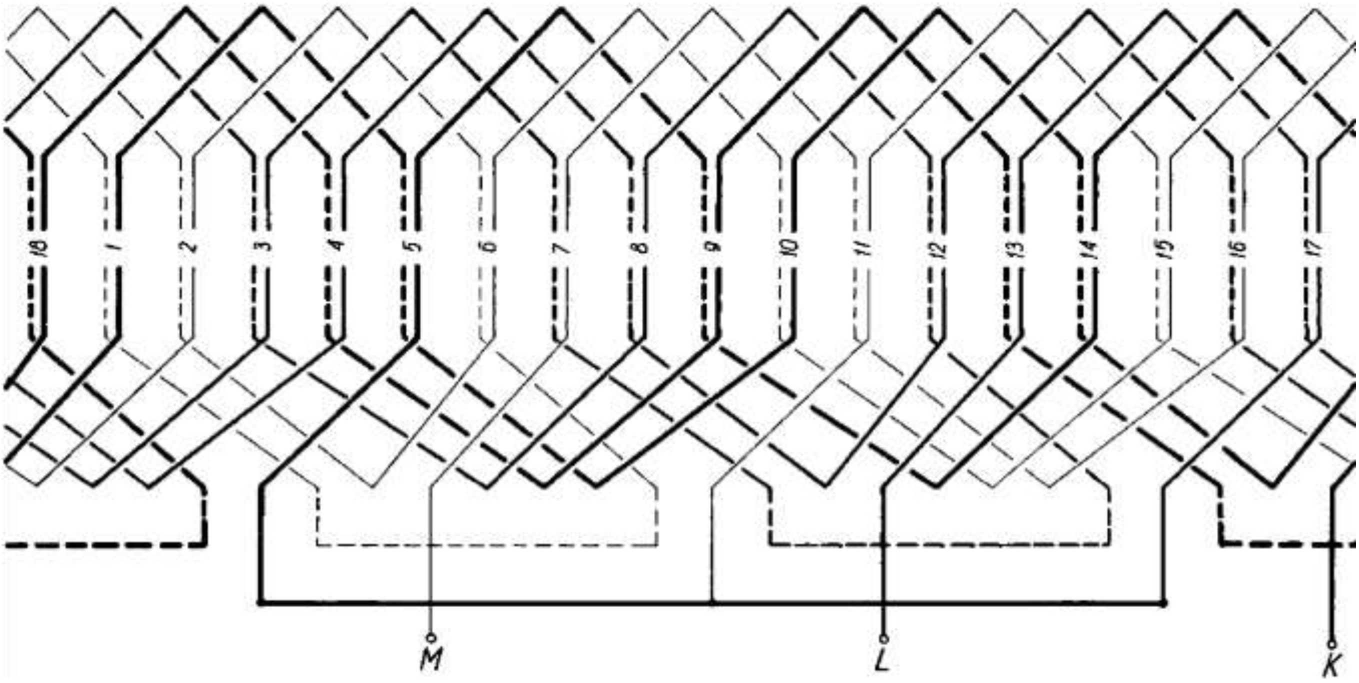


Figure. 104. Rotor Winding (Wave)
Slots = 18; Poles = 4; y = 4; q = 1 $^{1}/_{2}$

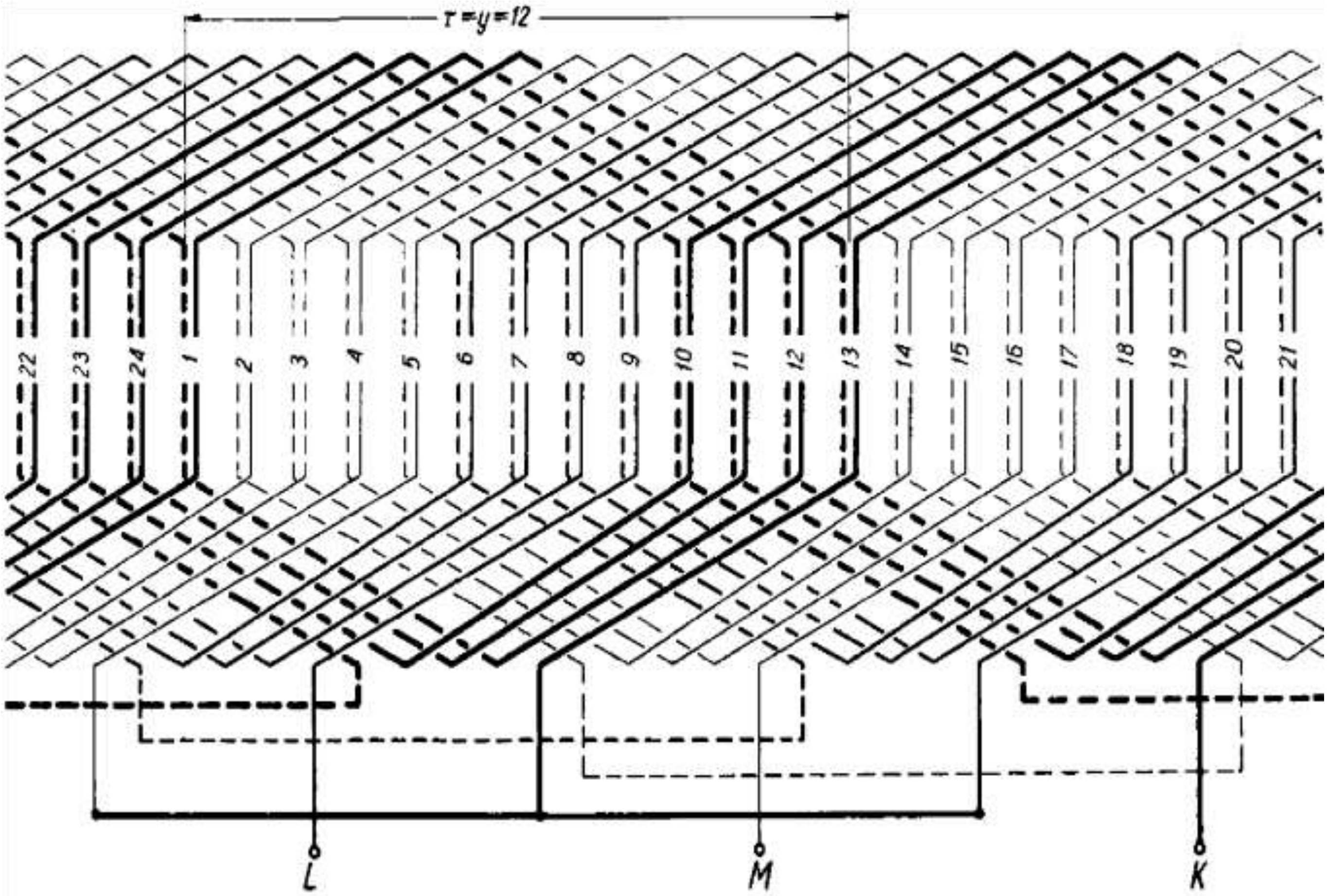


Figure. 105. Rotor Winding (Wave)
Slots = 24; Poles = 2; y = 12; q = 4

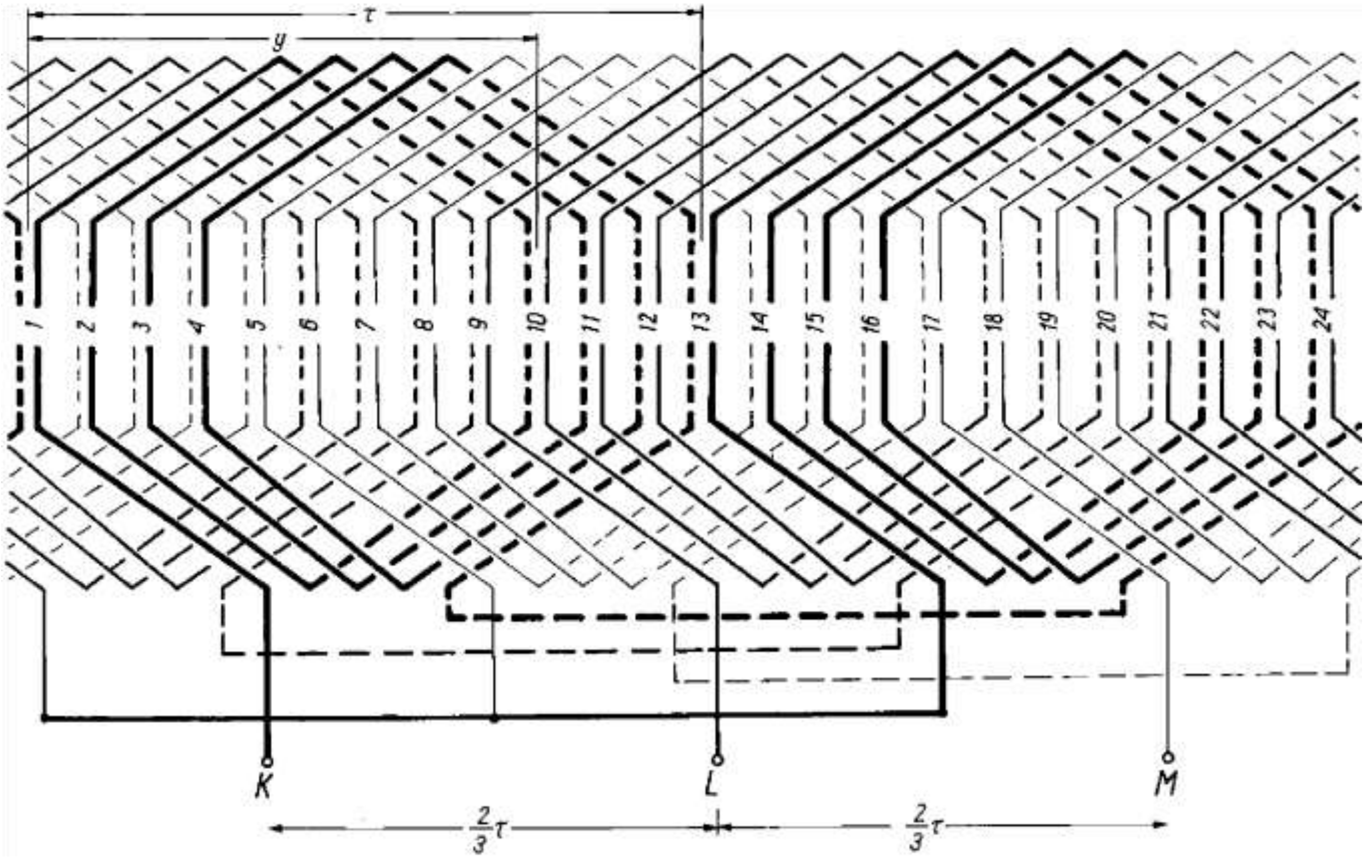


Figure. 106. Rotor Winding (Lap)
Slots = 24; Poles = 2; y = 9; q = 4

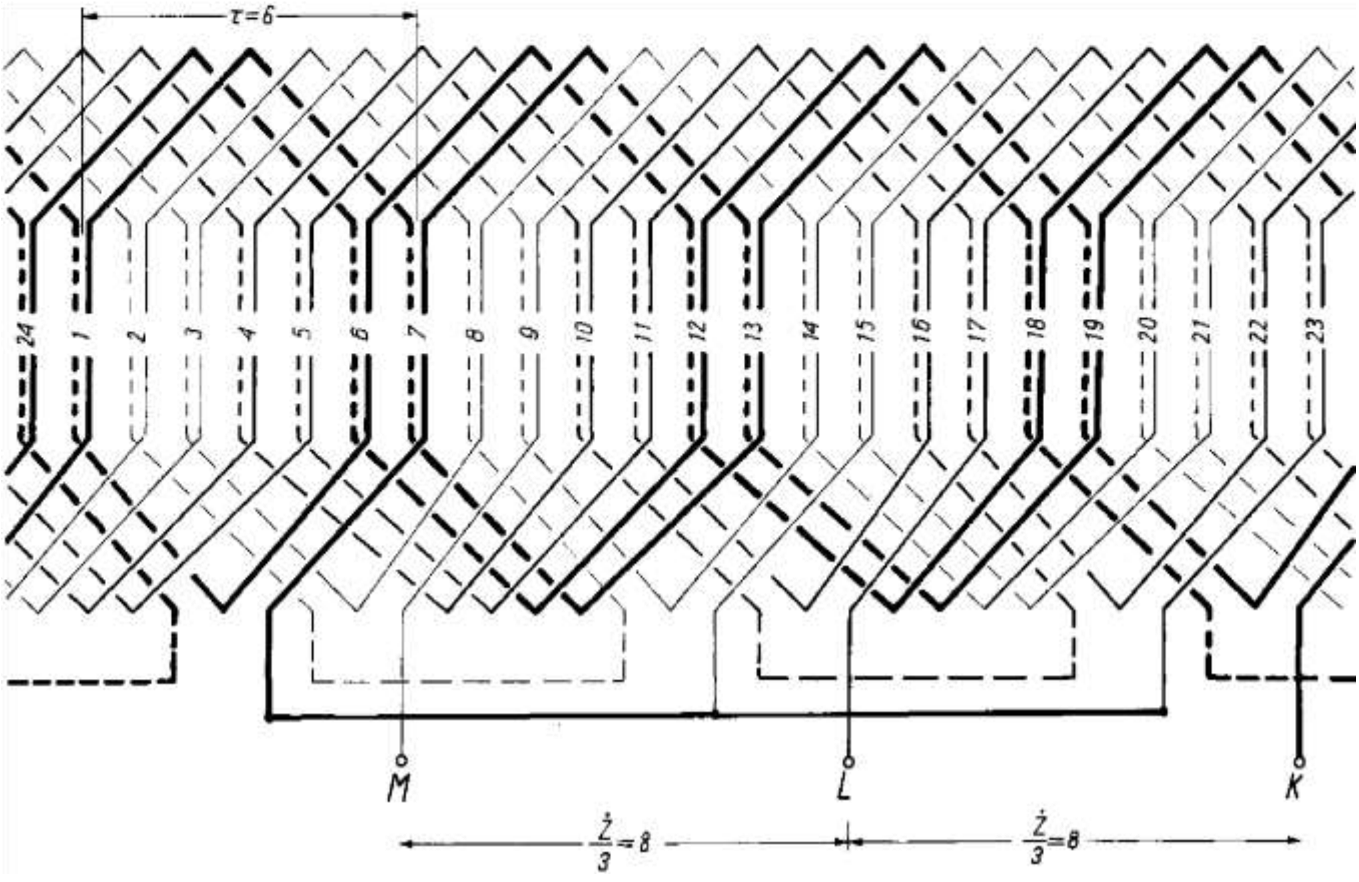


Figure. 107. Rotor Winding (Wave)
Slots = 24; Poles = 4; y = 6; q = 2

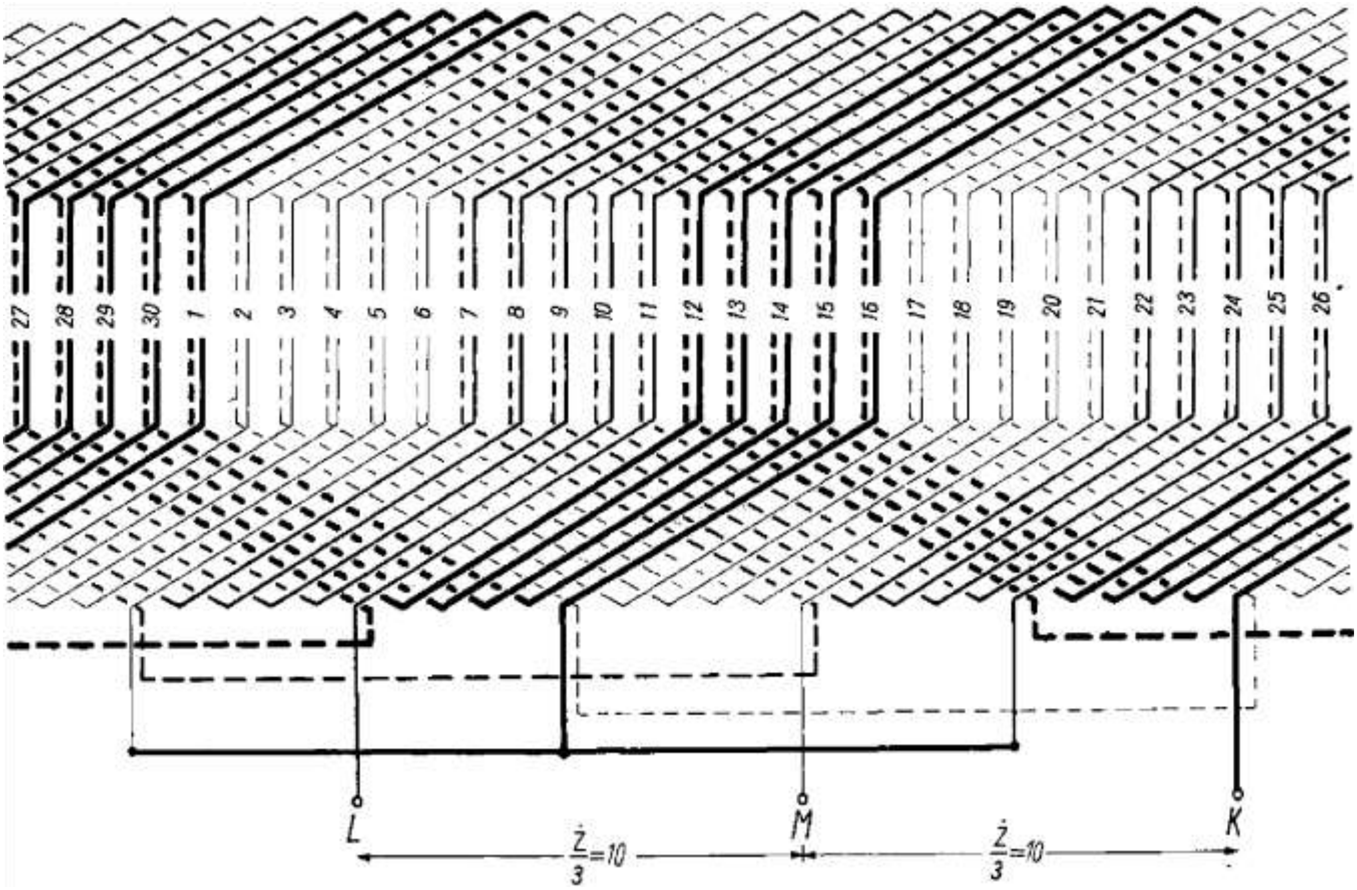


Figure. 108. Rotor Winding (Wave)
Slots = 30; Poles = 2; y = 15; q = 5

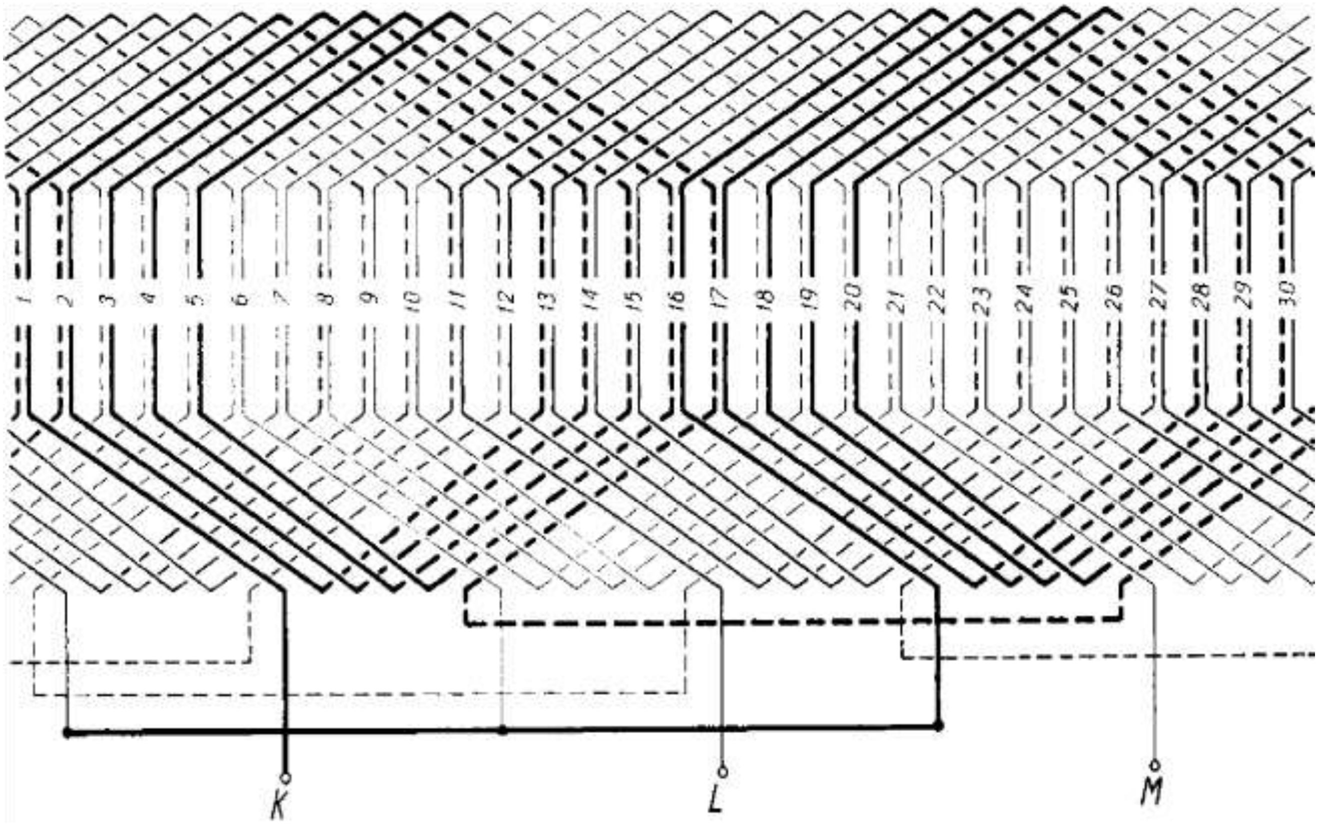


Figure. 109. Rotor Winding (Lap)
Slots = 30; Poles = 2; y = 12; q = 5

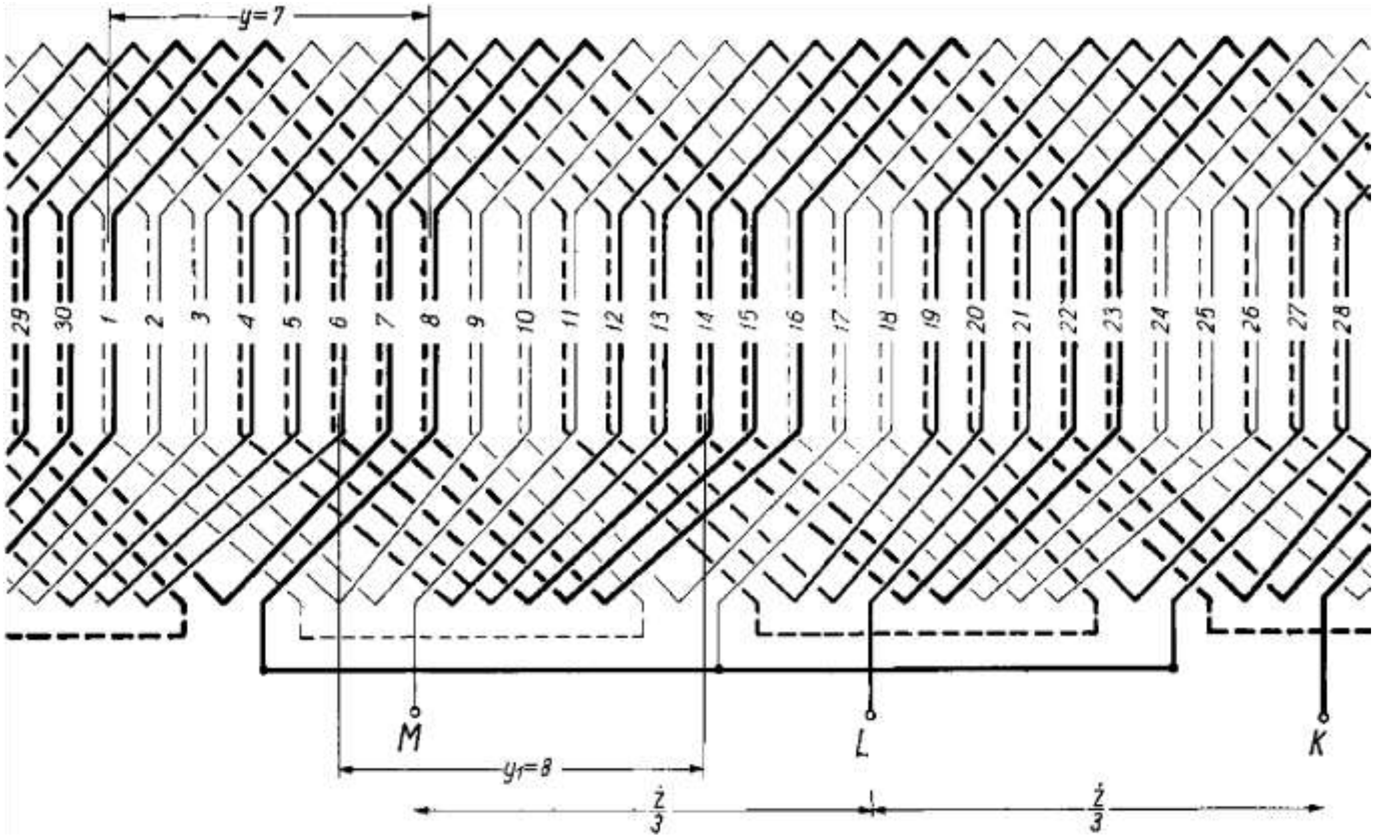


Figure. 110. Rotor Winding (Wave)
Slots = 30; Poles = 4; y = 7; q = 2 $^{1}/_{2}$

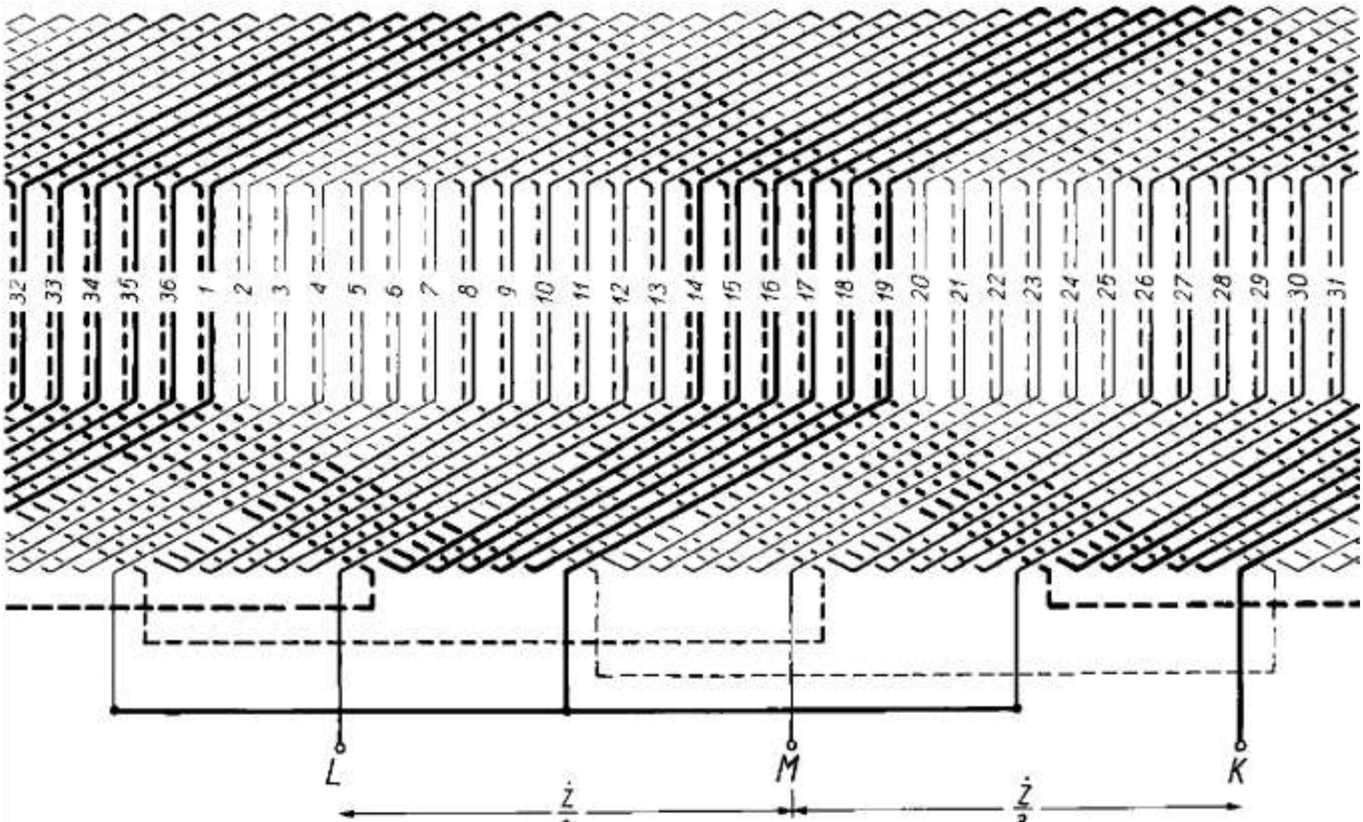


Figure. 111. Rotor Winding (Wave)
Slots = 36; Poles = 2; y = 18; q = 6

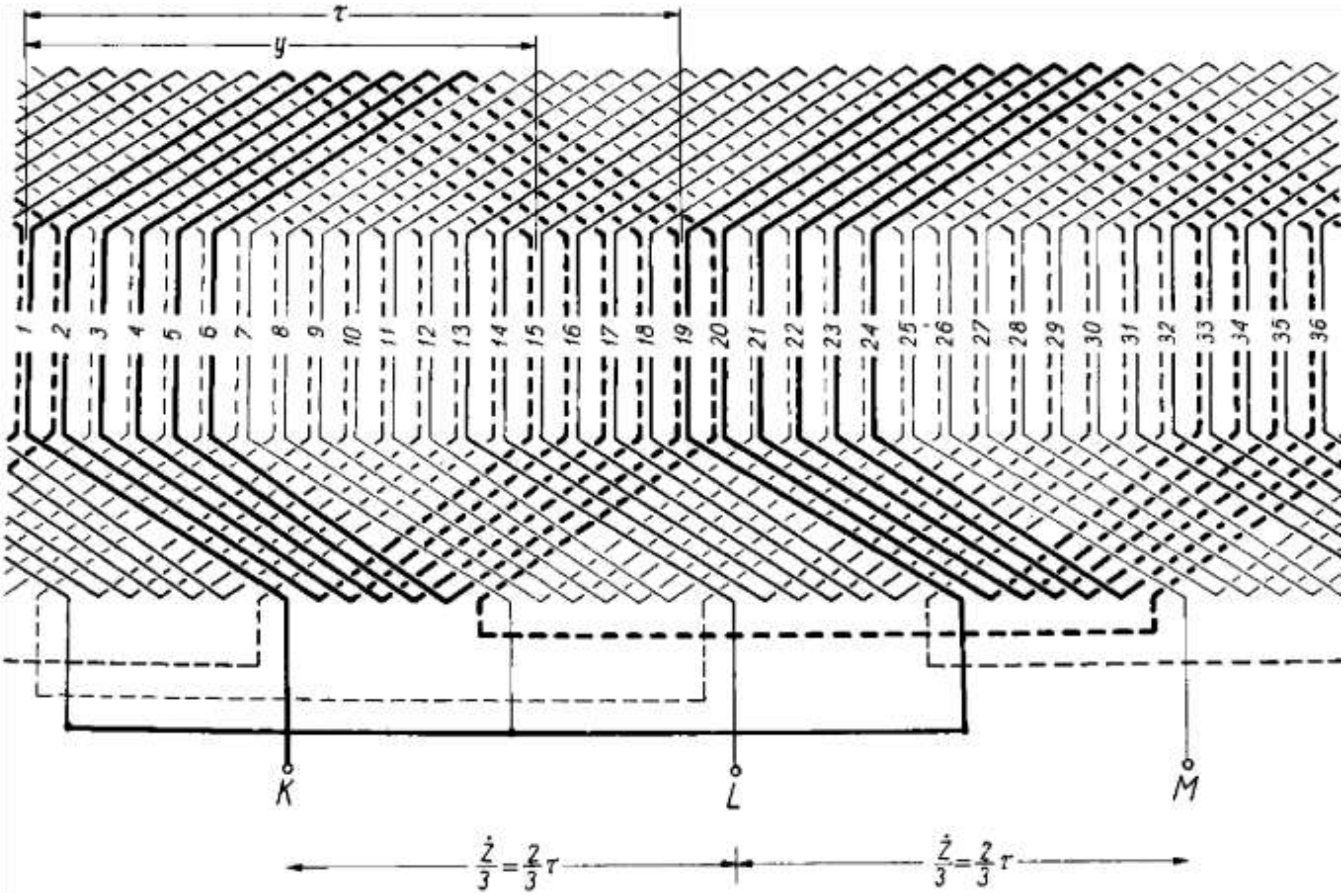


Figure. 112. Rotor Winding (Lap)
Slots = 36; Poles = 2; y = 14; q = 6

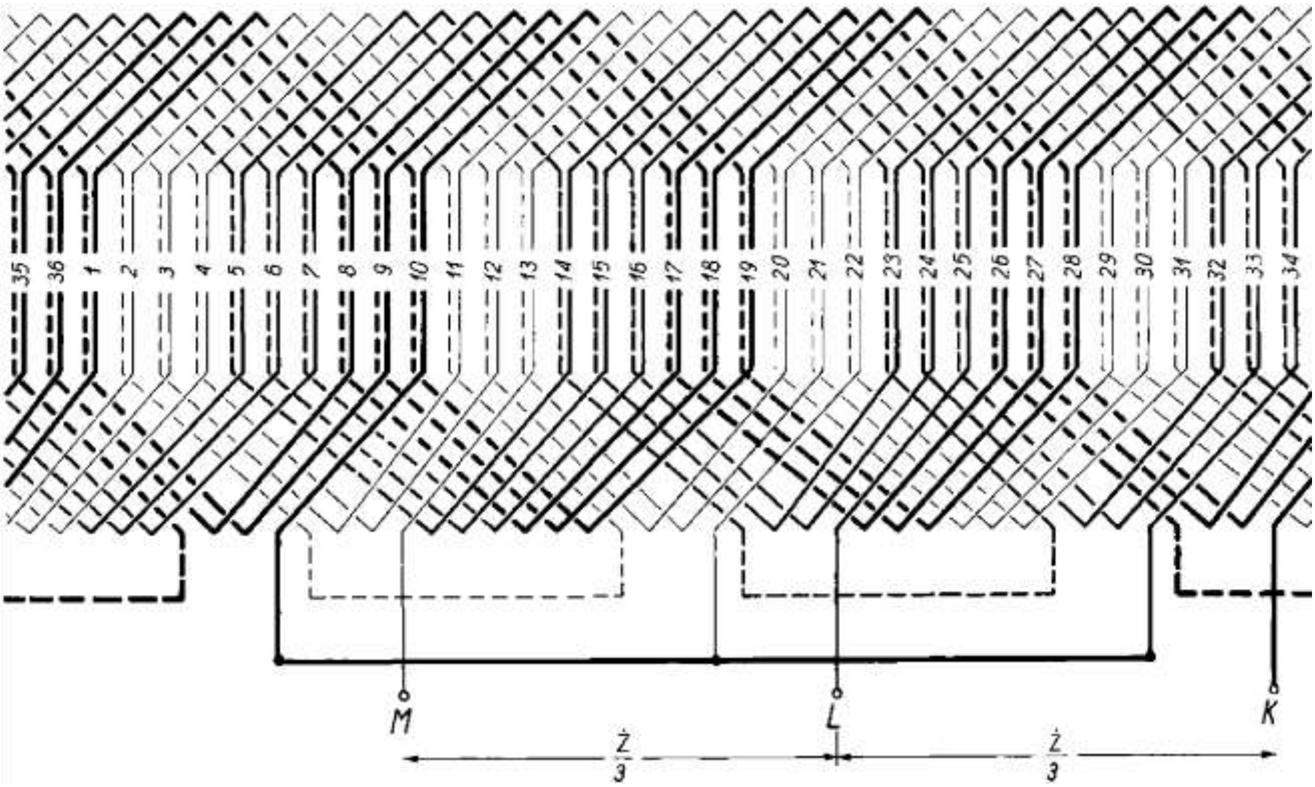


Figure. 113. Rotor Winding (Wave)
Slots=36; Poles = 4; y = 9; q = 3

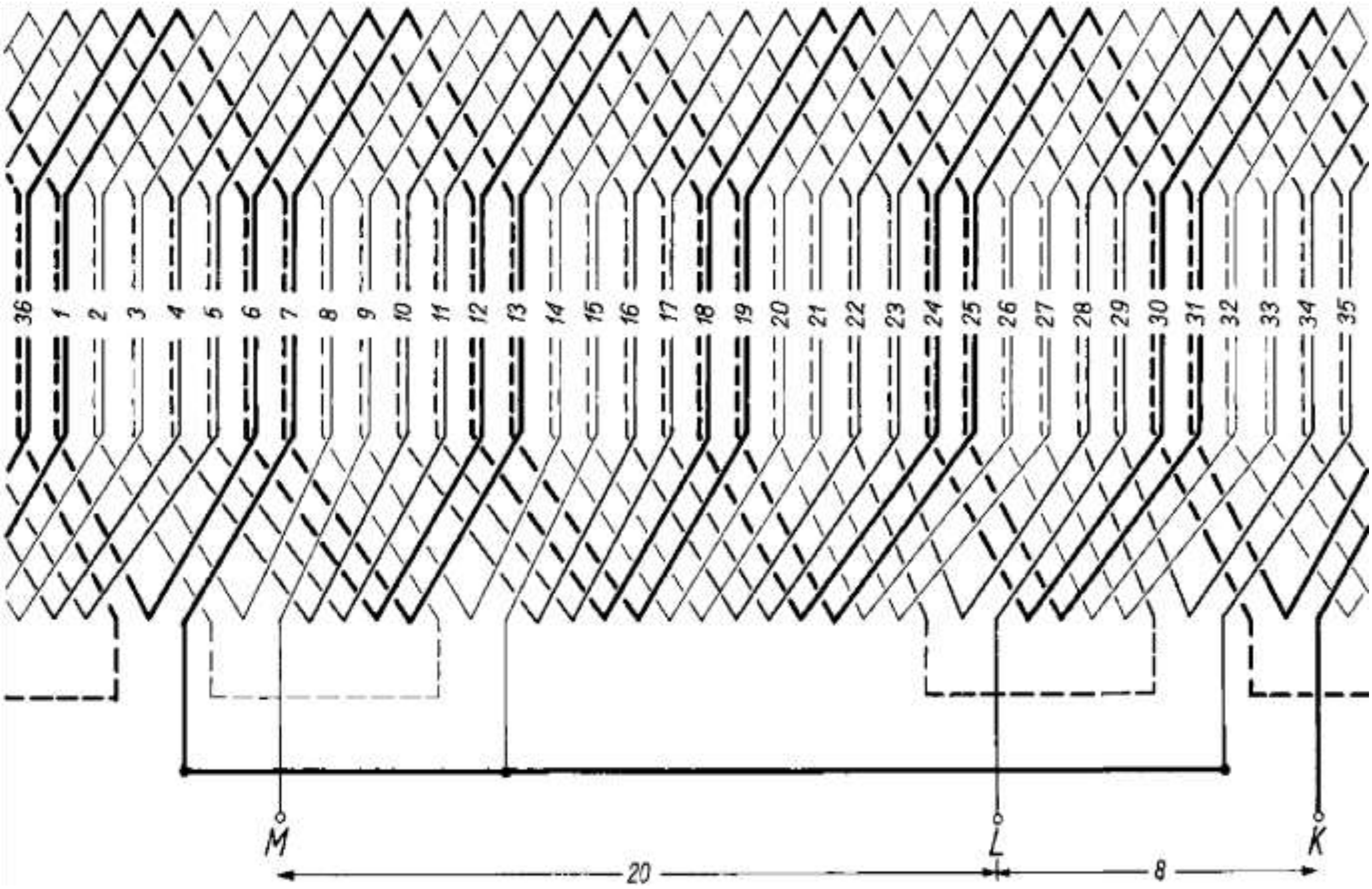


Figure. 114. Rotor Winding (Wave)
Slots = 36; Poles = 6; y = 6; q = 2

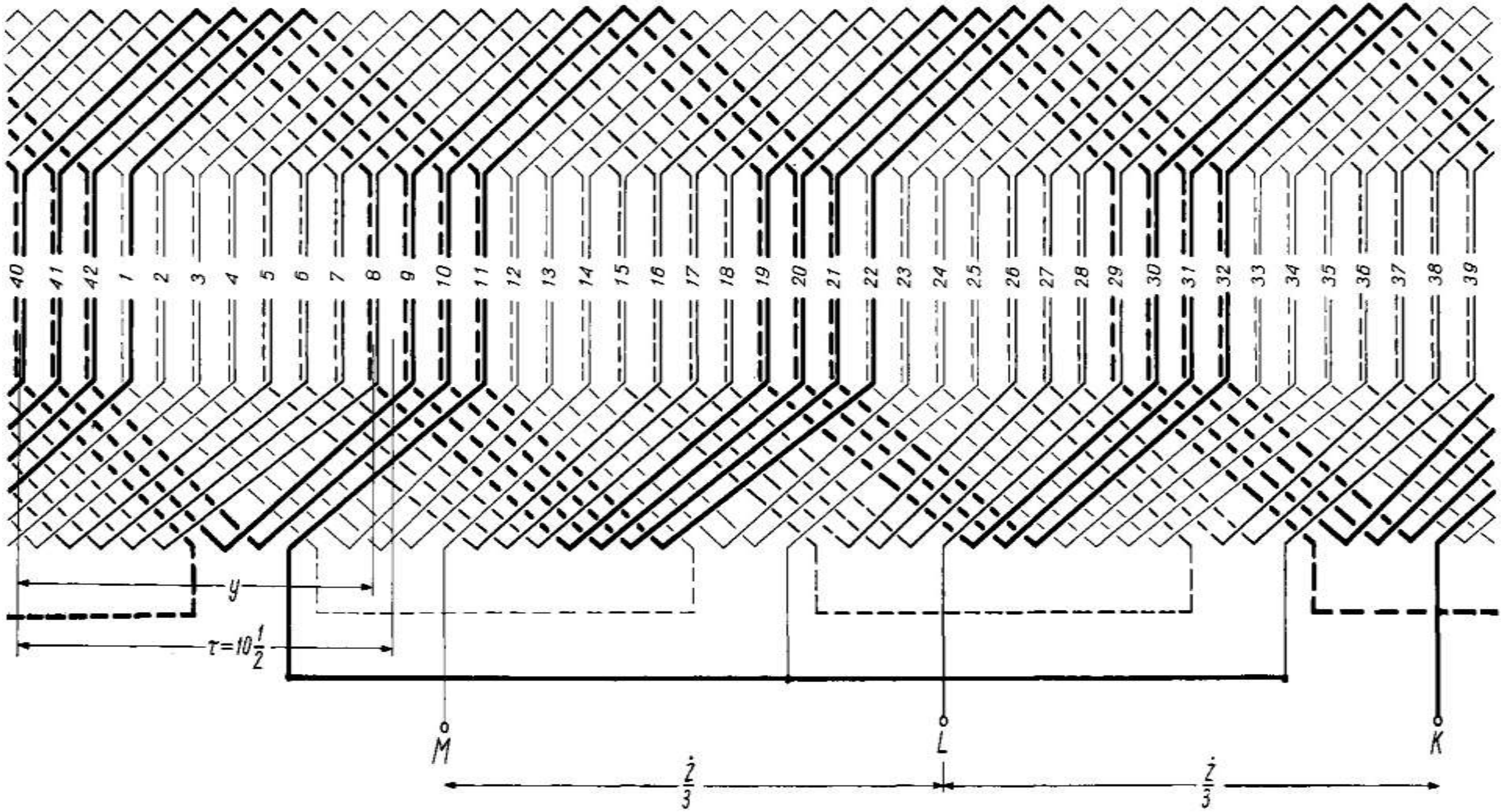


Figure. 115. Rotor Winding (Wave)
Slots = 42; Poles = 4; y = 10; q = 3 $^1/_2$

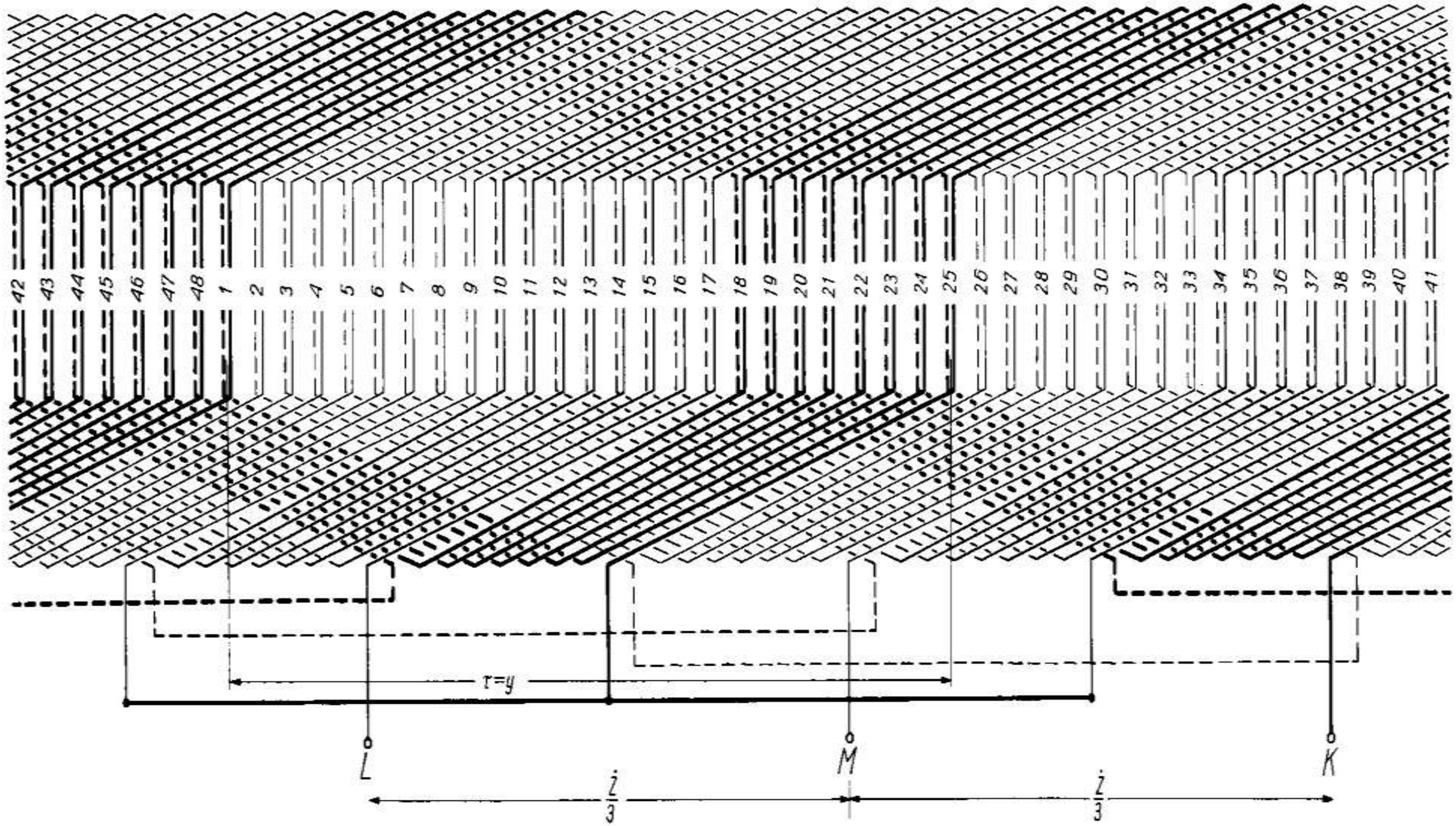


Figure. 116. Rotor Winding (Wave)
Slots = 48; Poles = 2; y = 24; q = 8

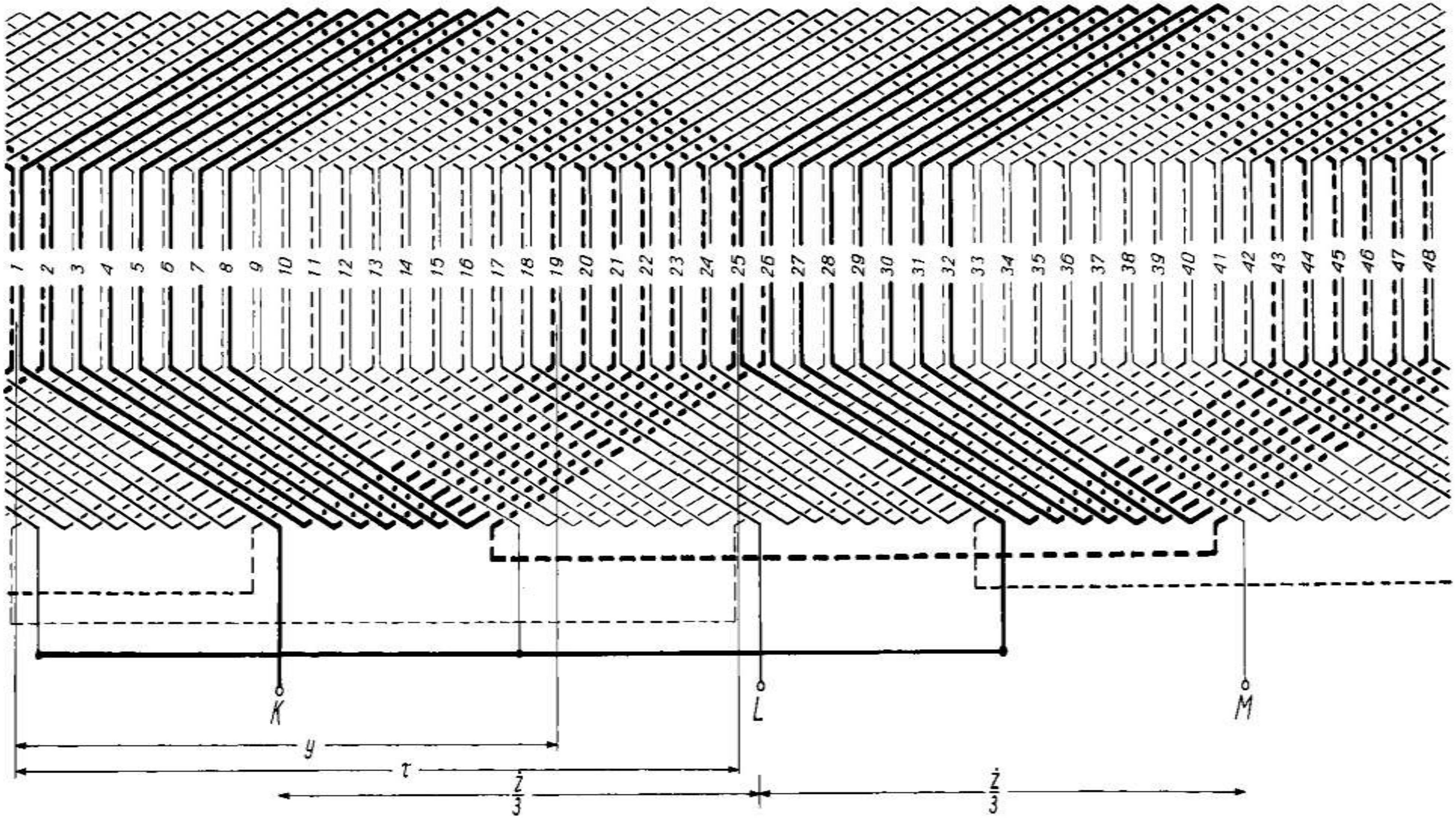


Figure. 117. Rotor Winding (Lap)
Slots = 48; Poles = 2; y = 18; q = 8

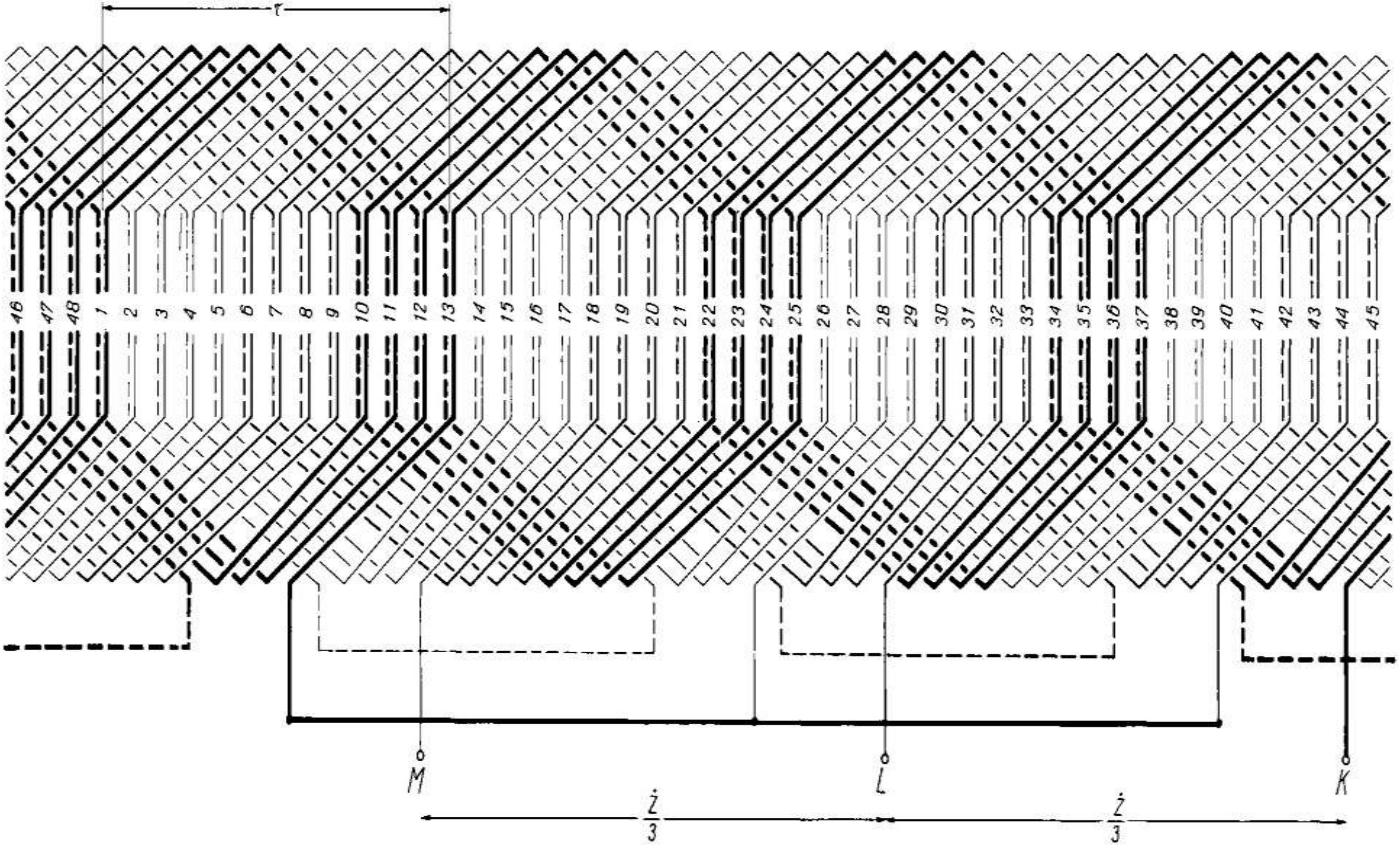


Figure. 118. Rotor Winding (Wave)
Slots = 48; Poles = 4; y = 12; q = 4

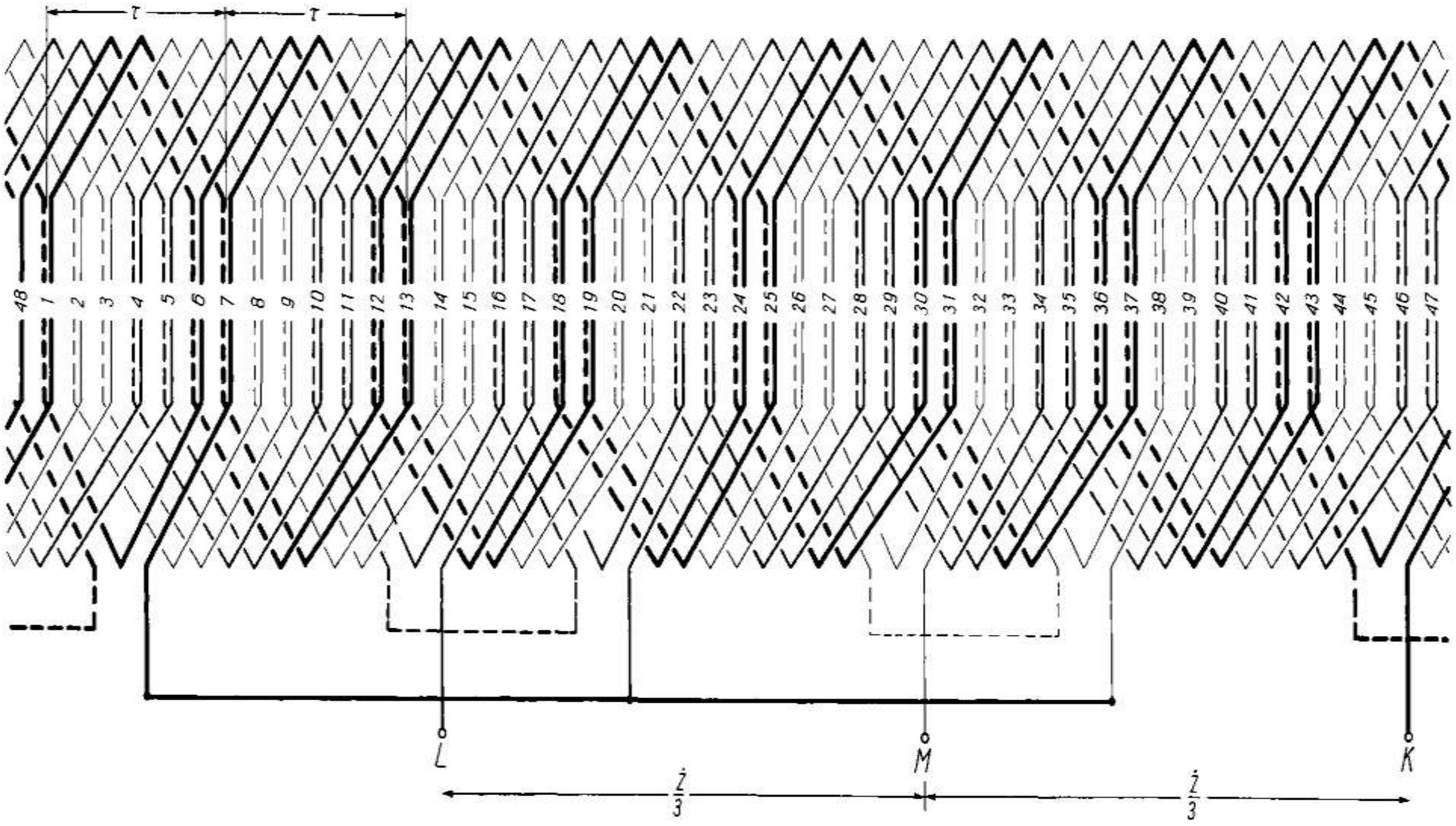


Figure. 119. Rotor Winding (Wave)
Slots = 48; Poles = 8; y = 6; q = 2

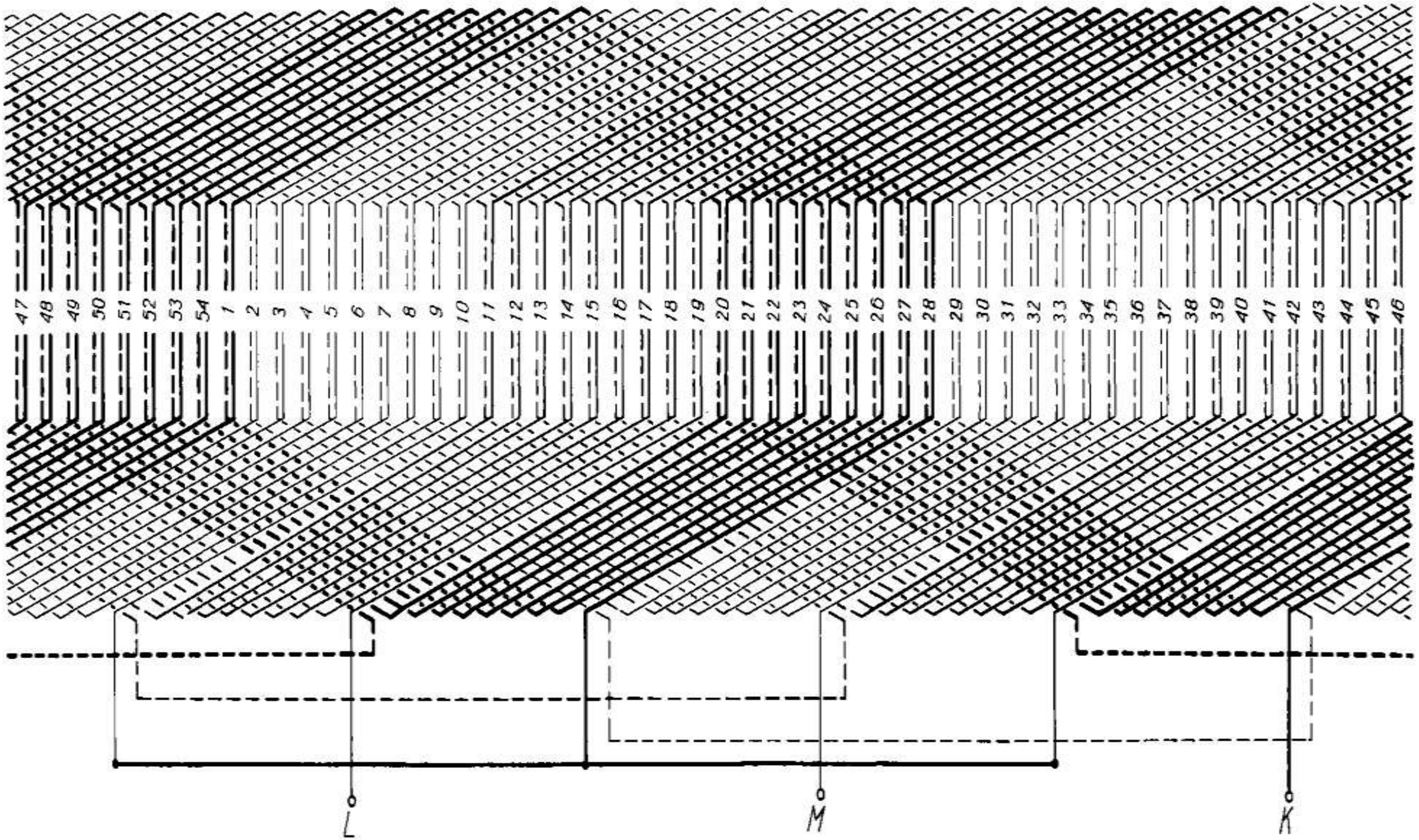


Figure. 120. Rotor Winding (Wave)
Slots = 54; Poles = 2; y = 27; q = 9

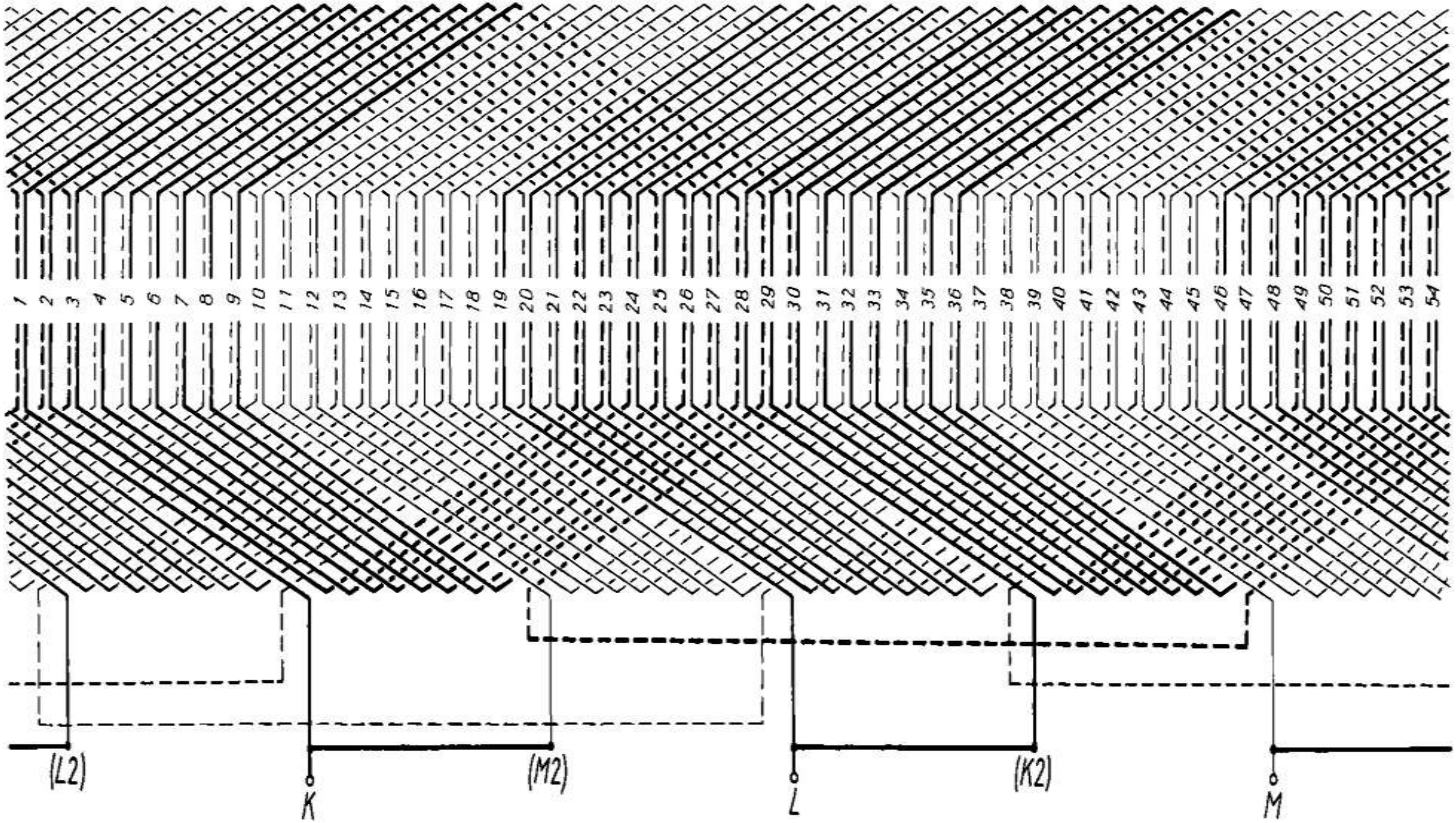


Figure. 121. Rotor Winding (Lap)
Slots = 54; Poles = 2; y = 21; q = 9

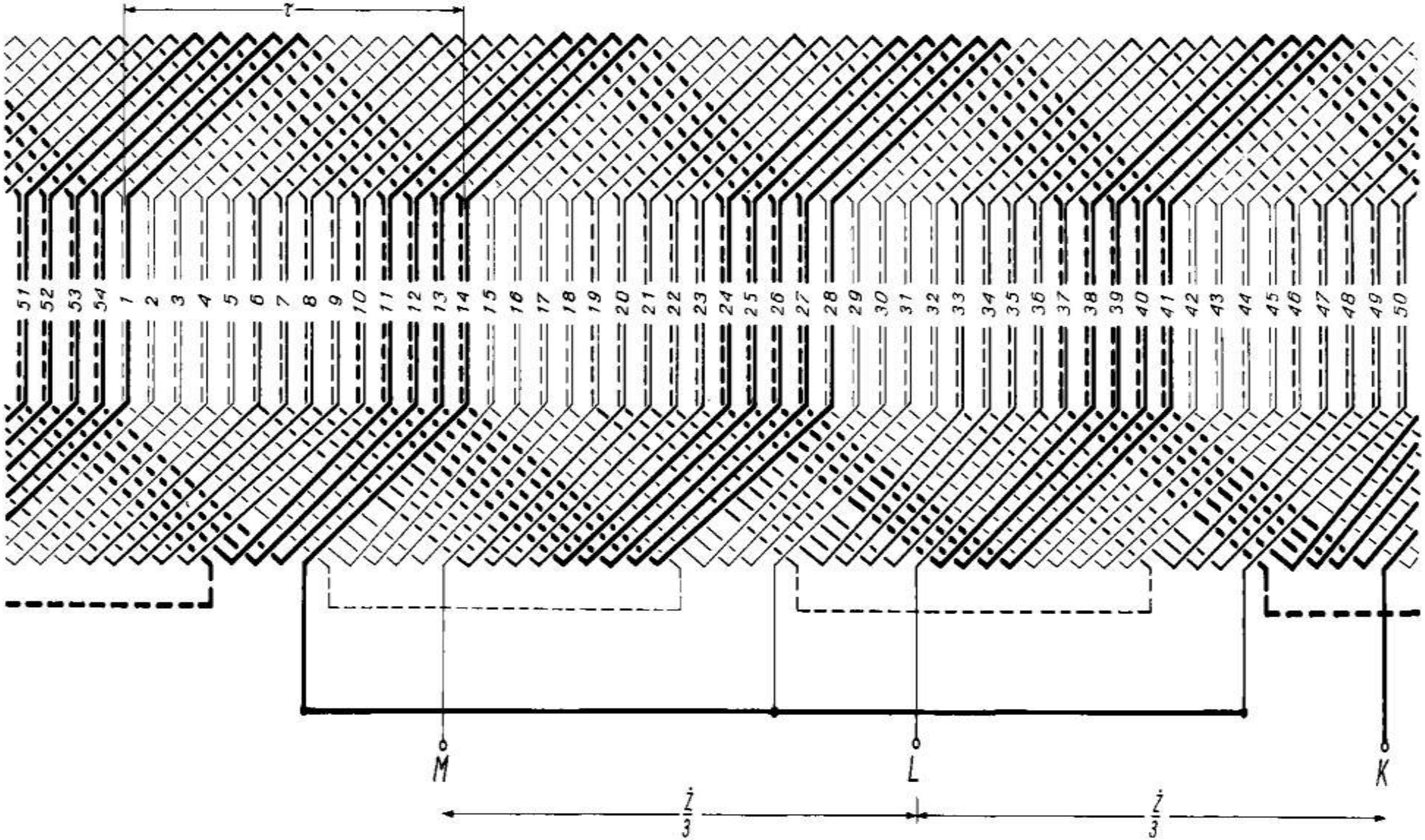


Figure. 122. Rotor Winding (Wave)
Slots = 54; Poles = 4; y = 13; q = 4 ½

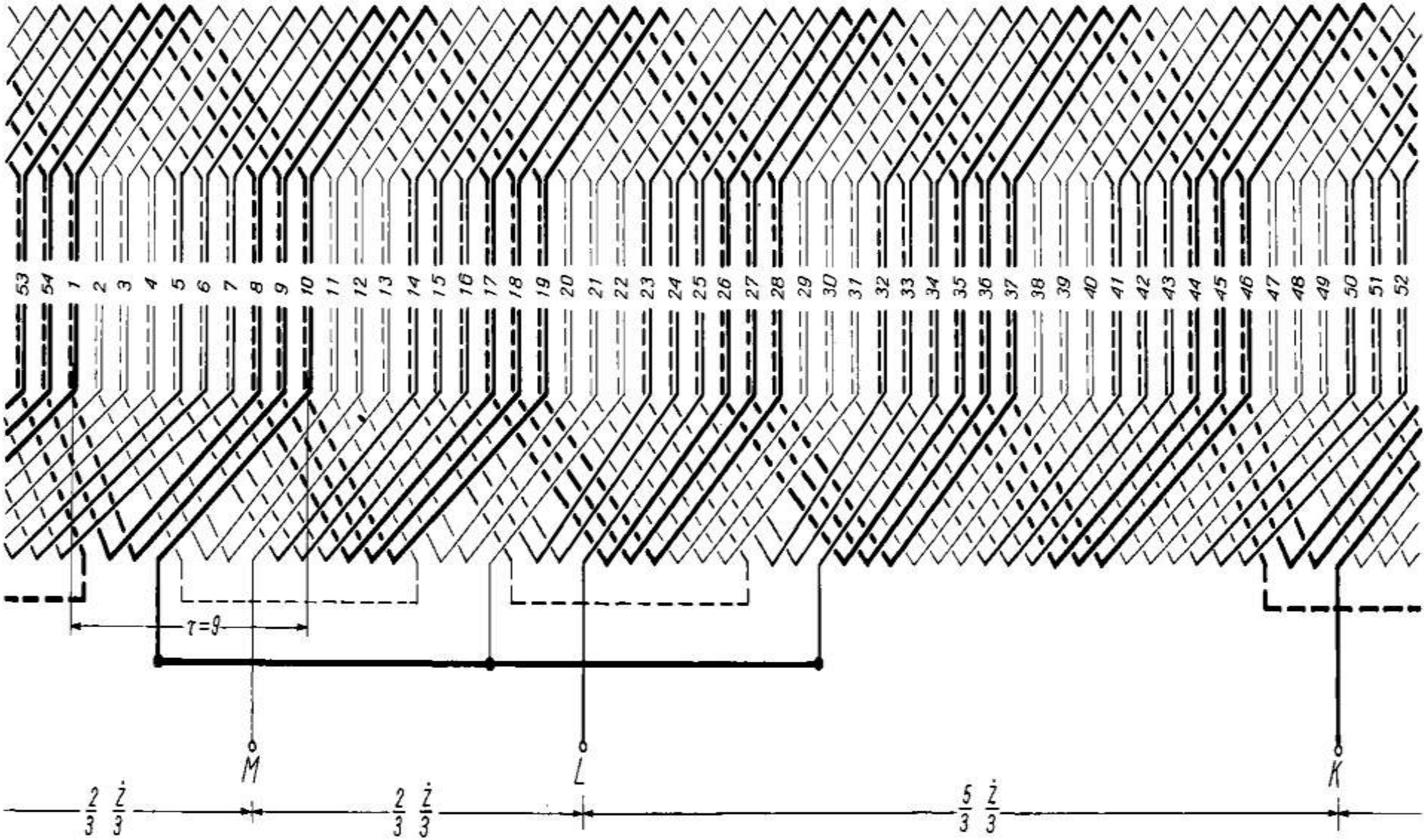


Figure. 123. Rotor Winding (Wave)
Slots = 54; Poles = 6; y = 9; q = 3

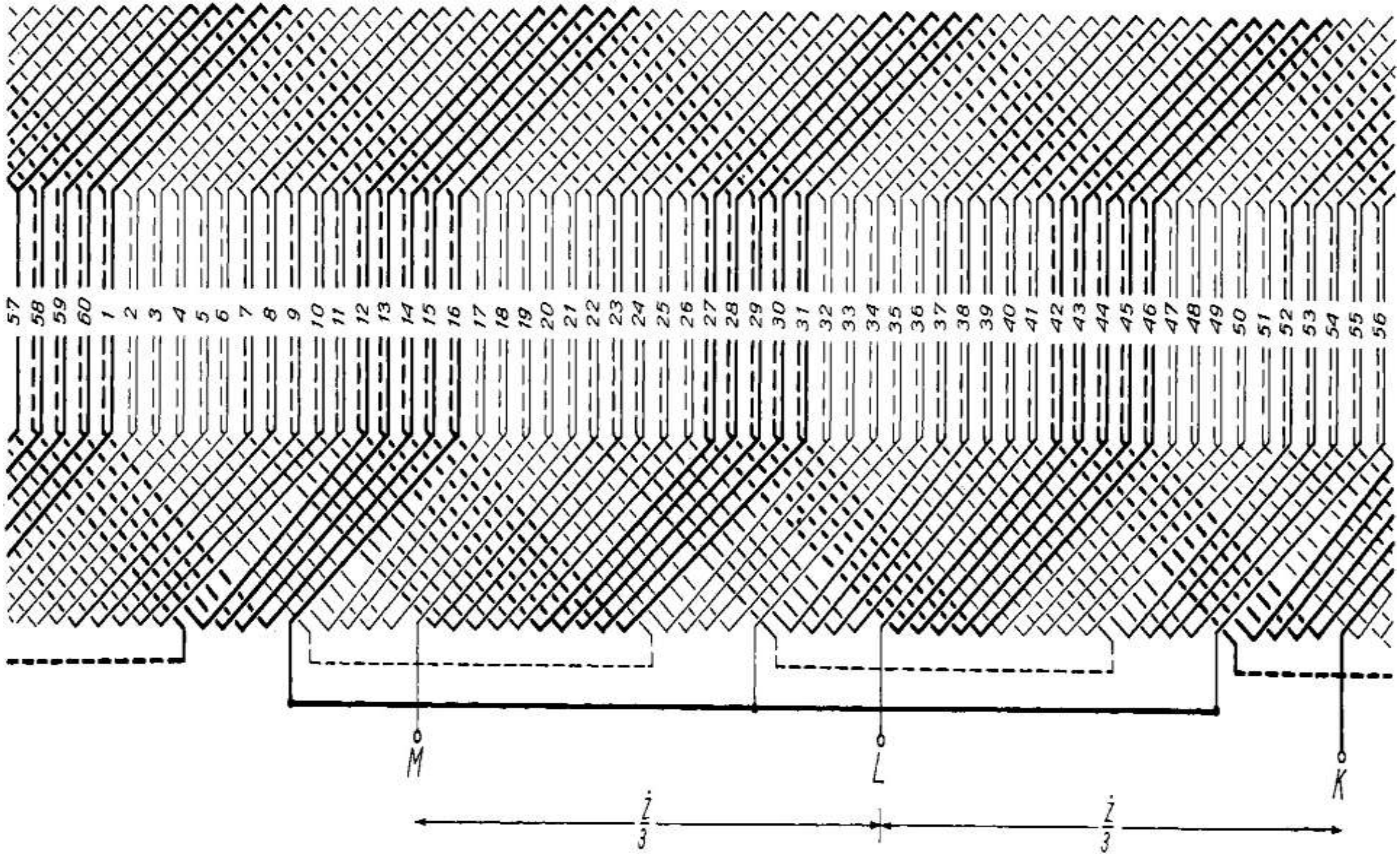


Figure. 124. Rotor Winding (Wave)
Slots = 60; Poles = 4; y = 15; q = 5

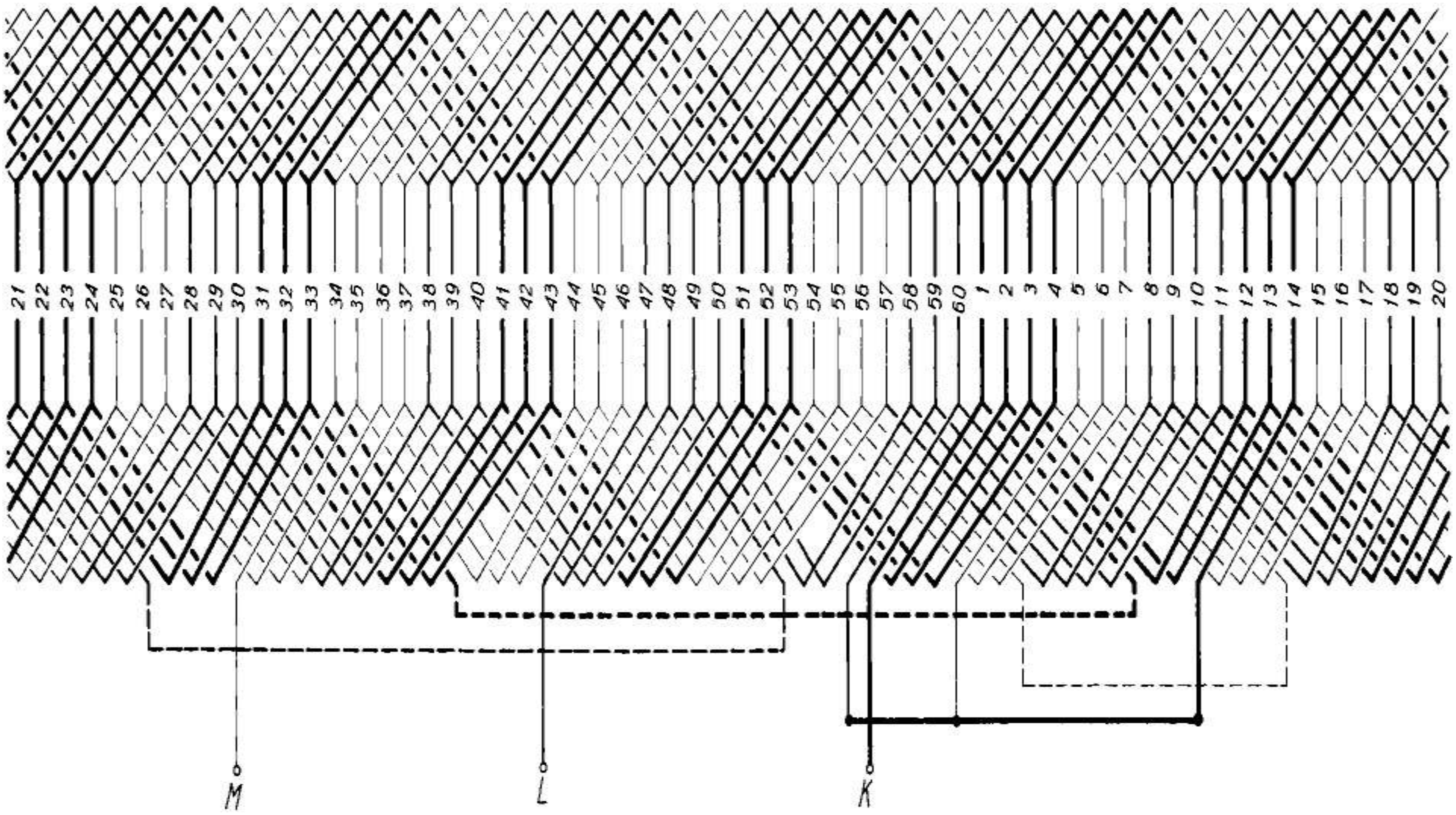


Figure. 125. Rotor Winding Lap (asymmetrical Winding, rarely used)
Slots = 60; Poles = 6; y = 10; q = 3 $^1/_3$

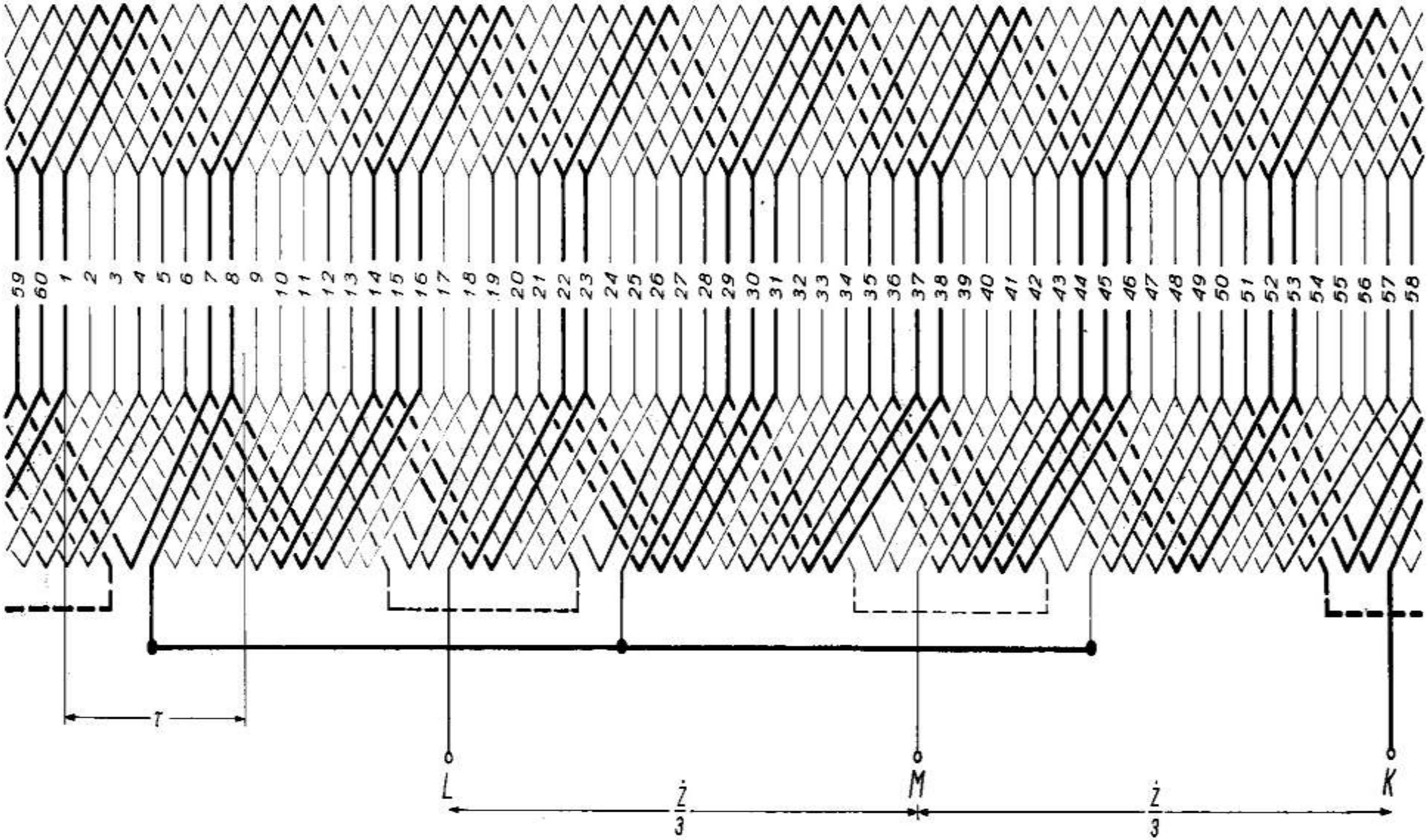


Figure. 126. Rotor Winding (Wave)
Slots = 60; Poles = 8; y = 7; q = 2 $^{1}/_{2}$

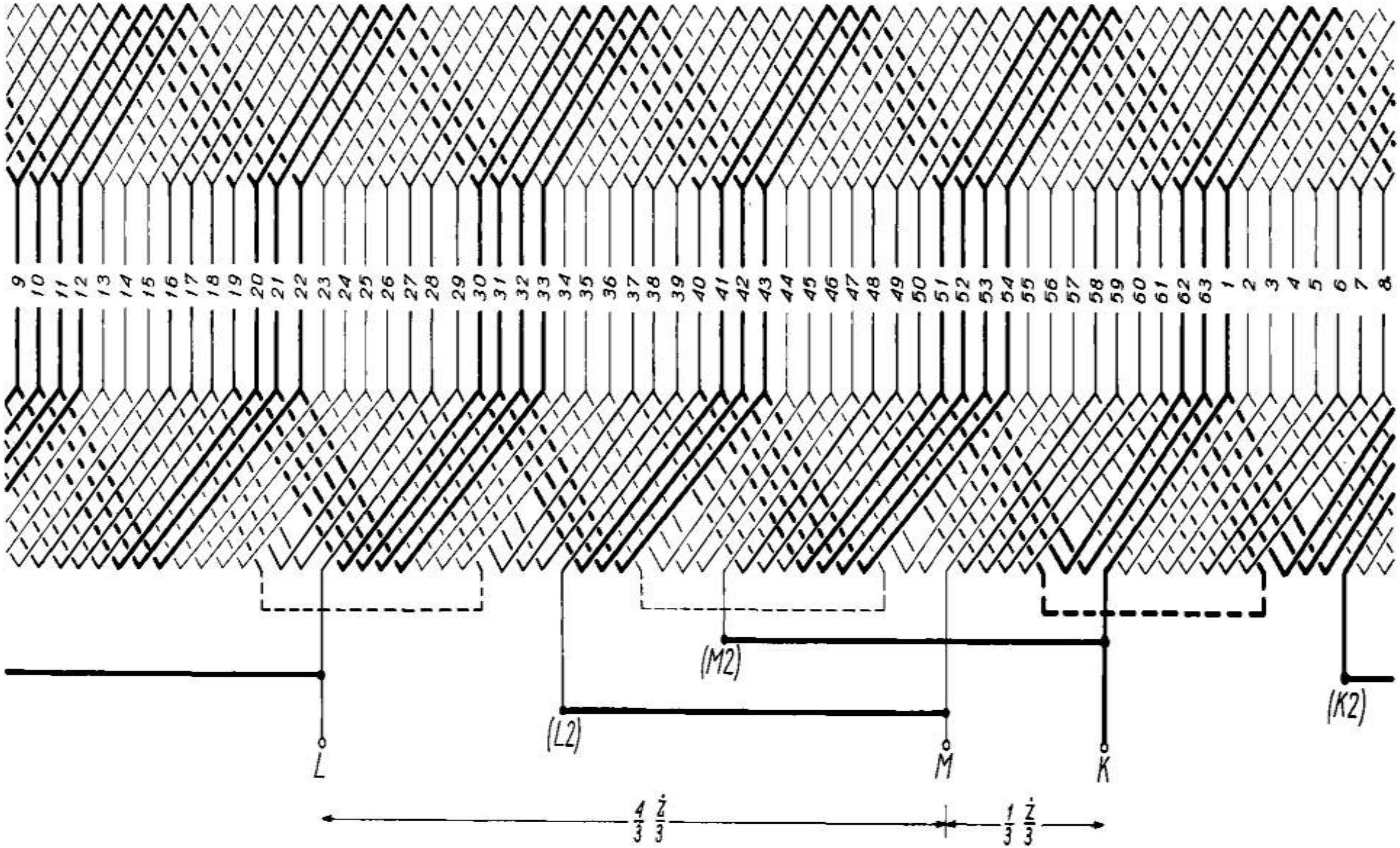


Figure. 127. Rotor Winding (Wave) (joined in delta)
Slots = 63; Poles = 6; y = 10; q = 3 $^1/_2$

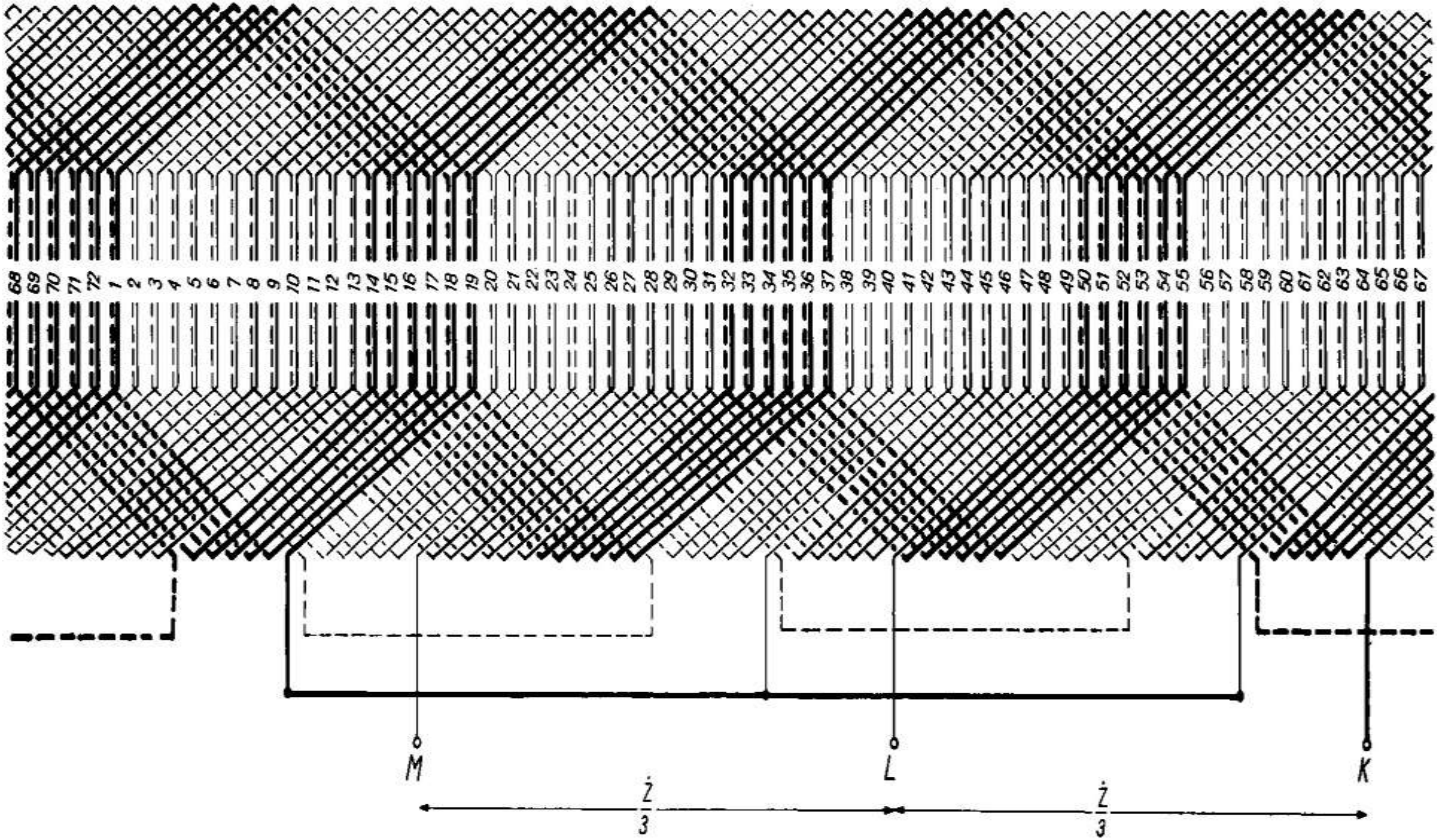


Figure. 128. Rotor Winding (Wave)
Slots = 72; Poles = 4; y = 18; q = 6

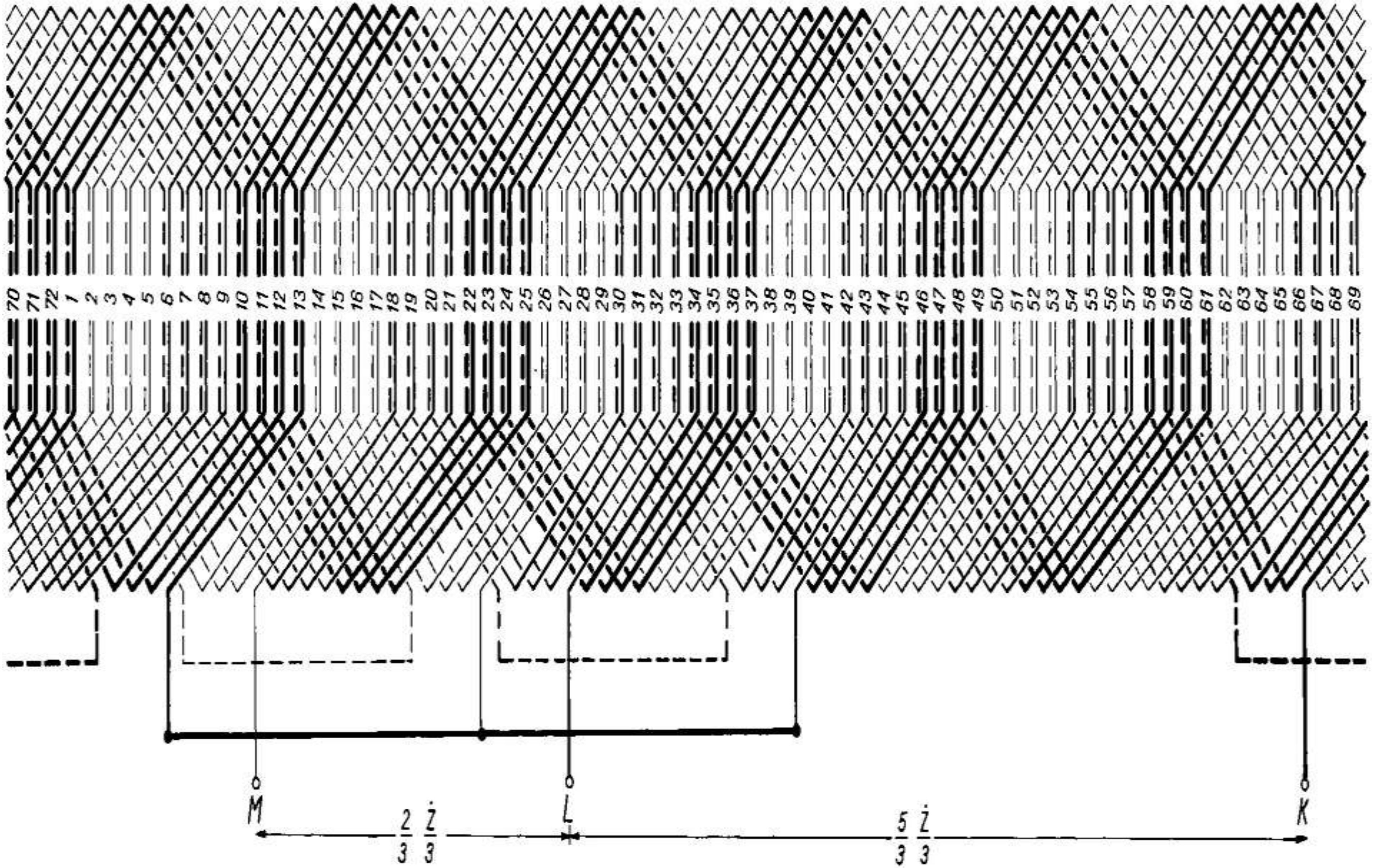


Figure. 129. Rotor Winding (Wave)
Slots = 72; Poles = 6; y=12; q = 4

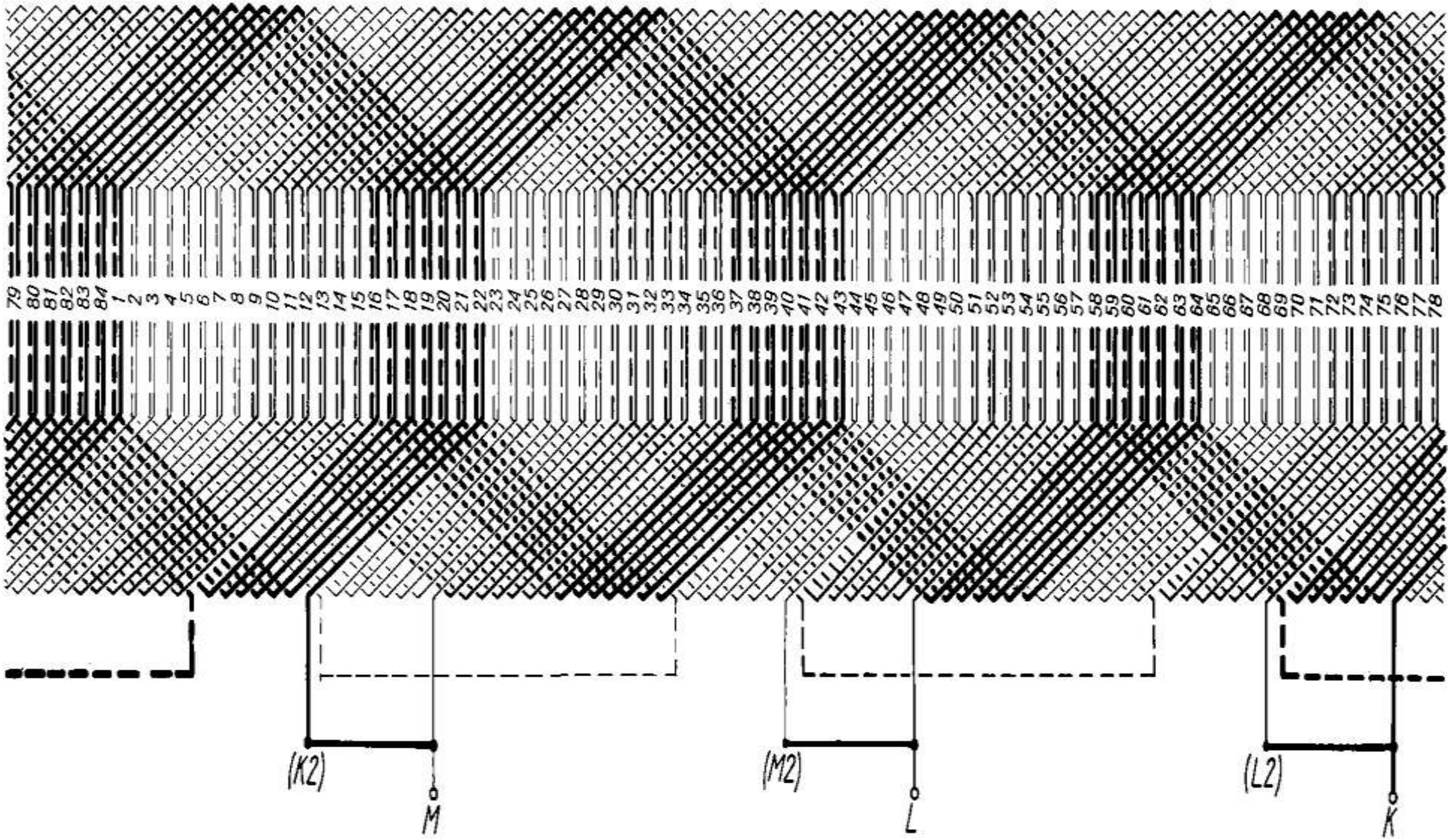


Figure. 130. Rotor Winding (Wave) (joined in delta)
Slots = 84; Poles = 4; y = 21; q = 7

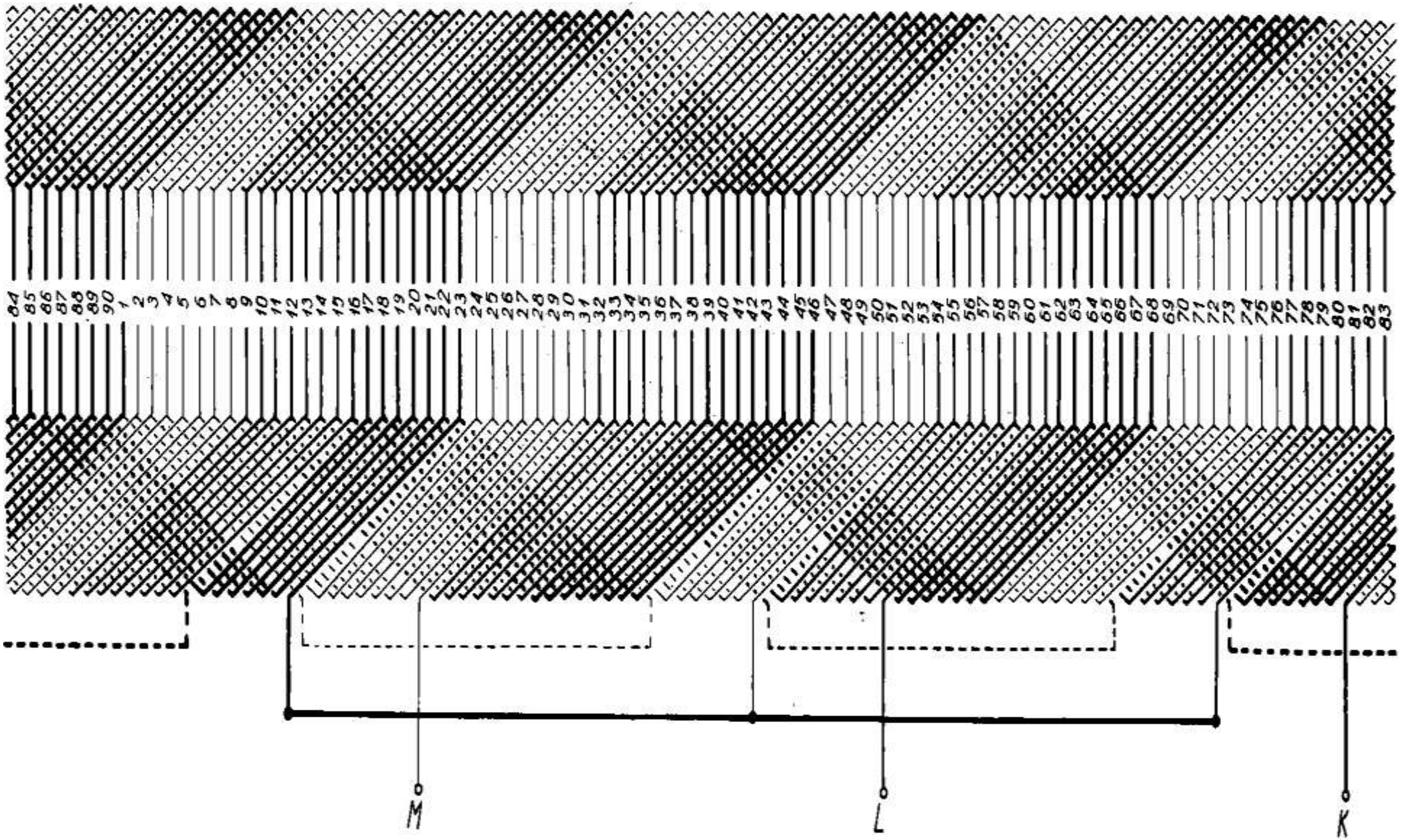


Figure. 131. Rotor Winding (Wave)
Slots = 90; Poles = 4; y = 22; q = 7 $^1/_2$

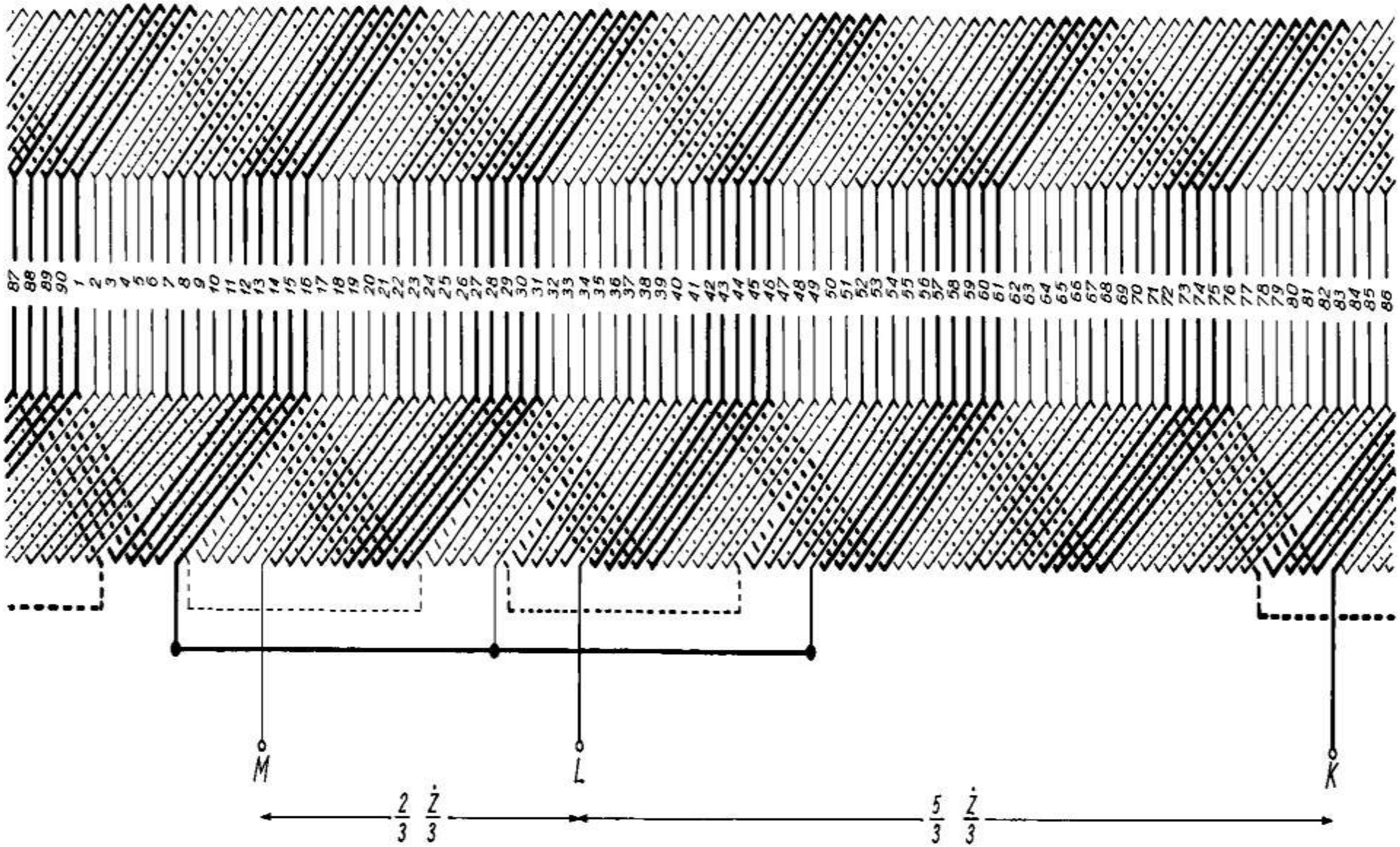


Figure. 132. Rotor Winding (Wave)
Slots = 90; Poles = 6; y = 15; q = 5

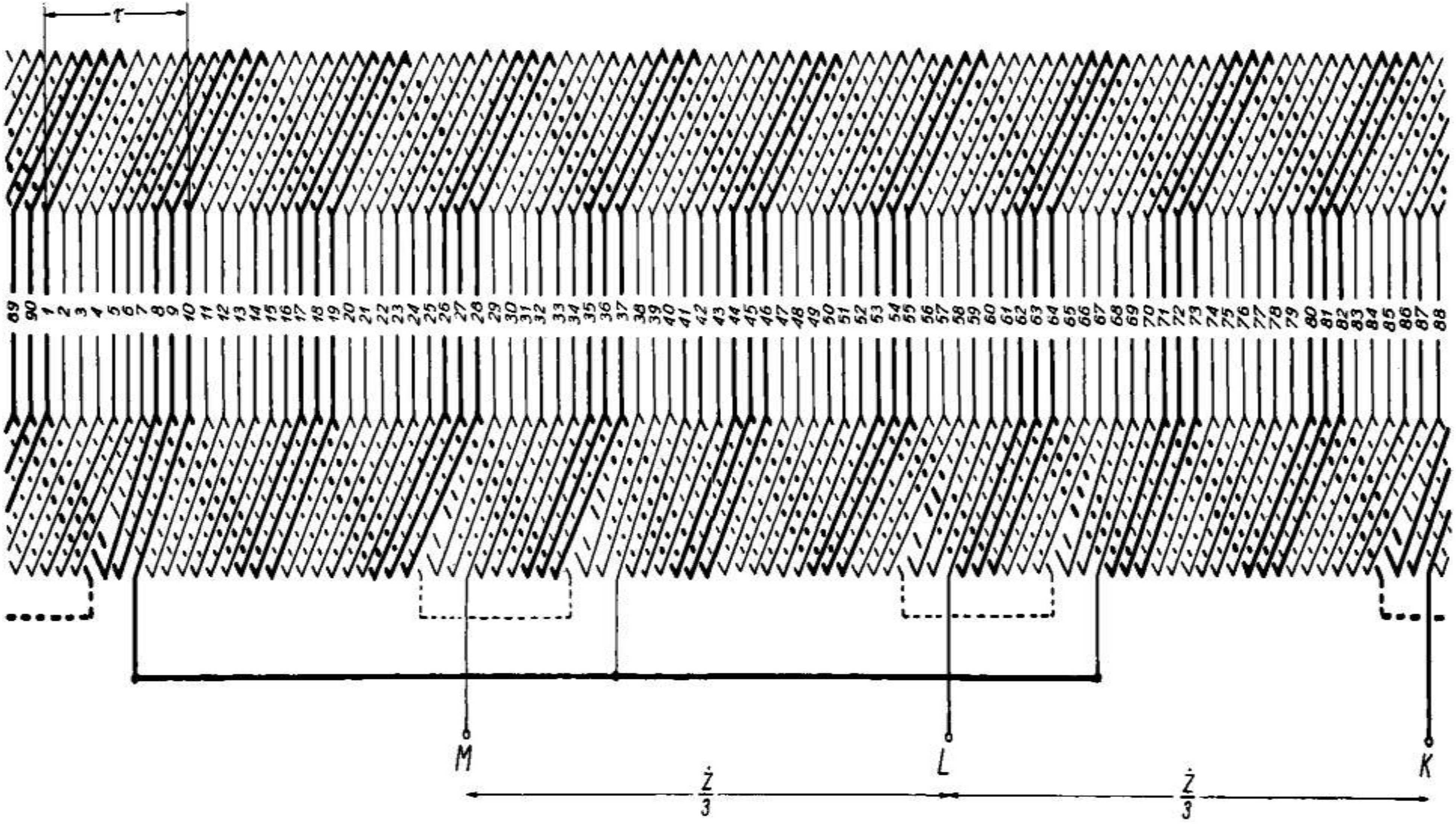


Figure. 133. Rotor Winding (Wave)
Slots = 90; Poles = 10; y = 9; q = 3

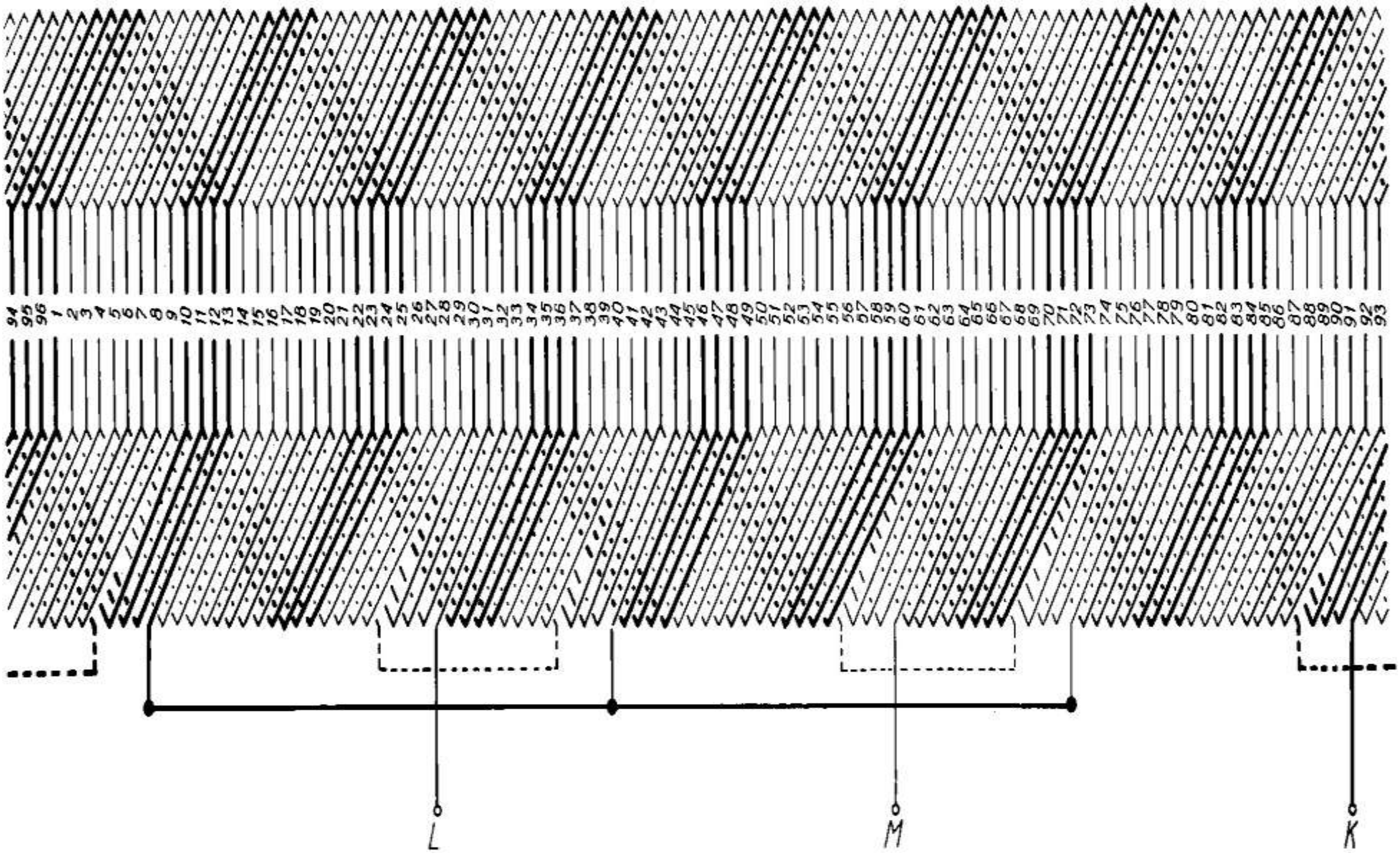


Figure. 134. Rotor Winding (Wave)
Slots = 96; Poles = 8; y = 12; q = 4

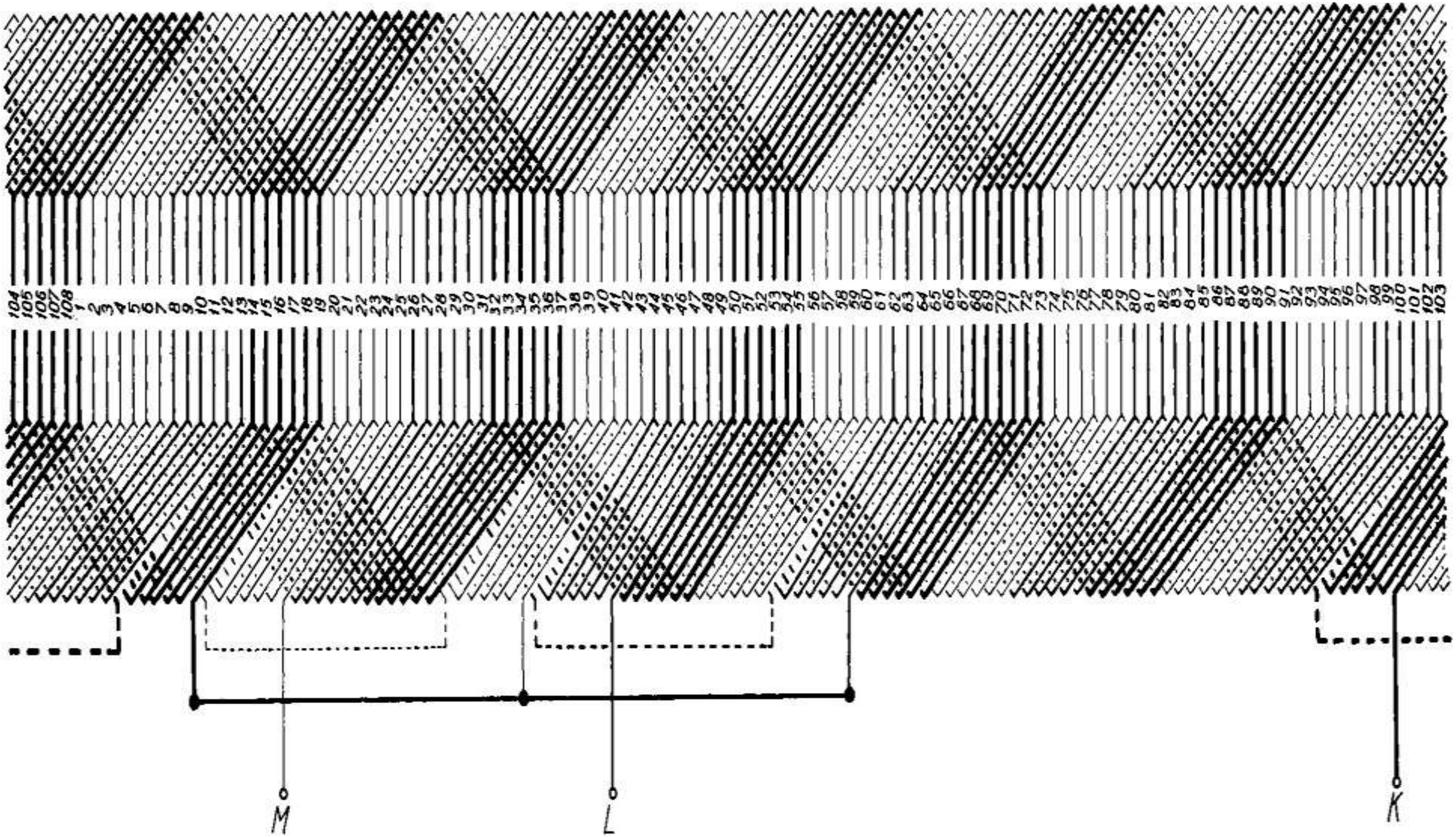


Figure. 135. Rotor Winding (Wave)
Slots = 108; Poles = 6; y = 18; q = 6

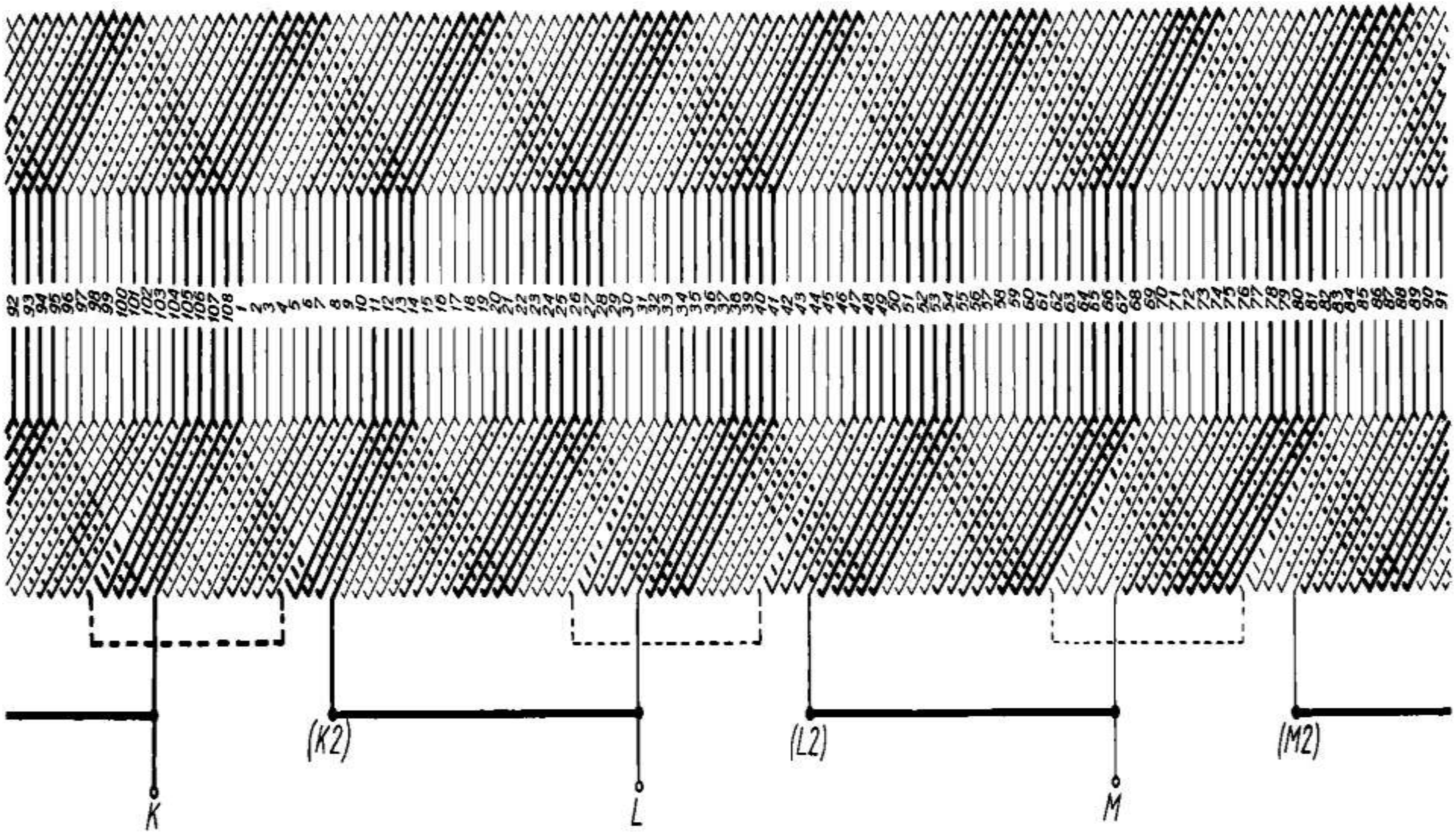


Figure. 136. Rotor Winding (Wave) (joined in delta)
Slots = 108; Poles = 8; y = 13; q = 4 $^{1}/_{2}$

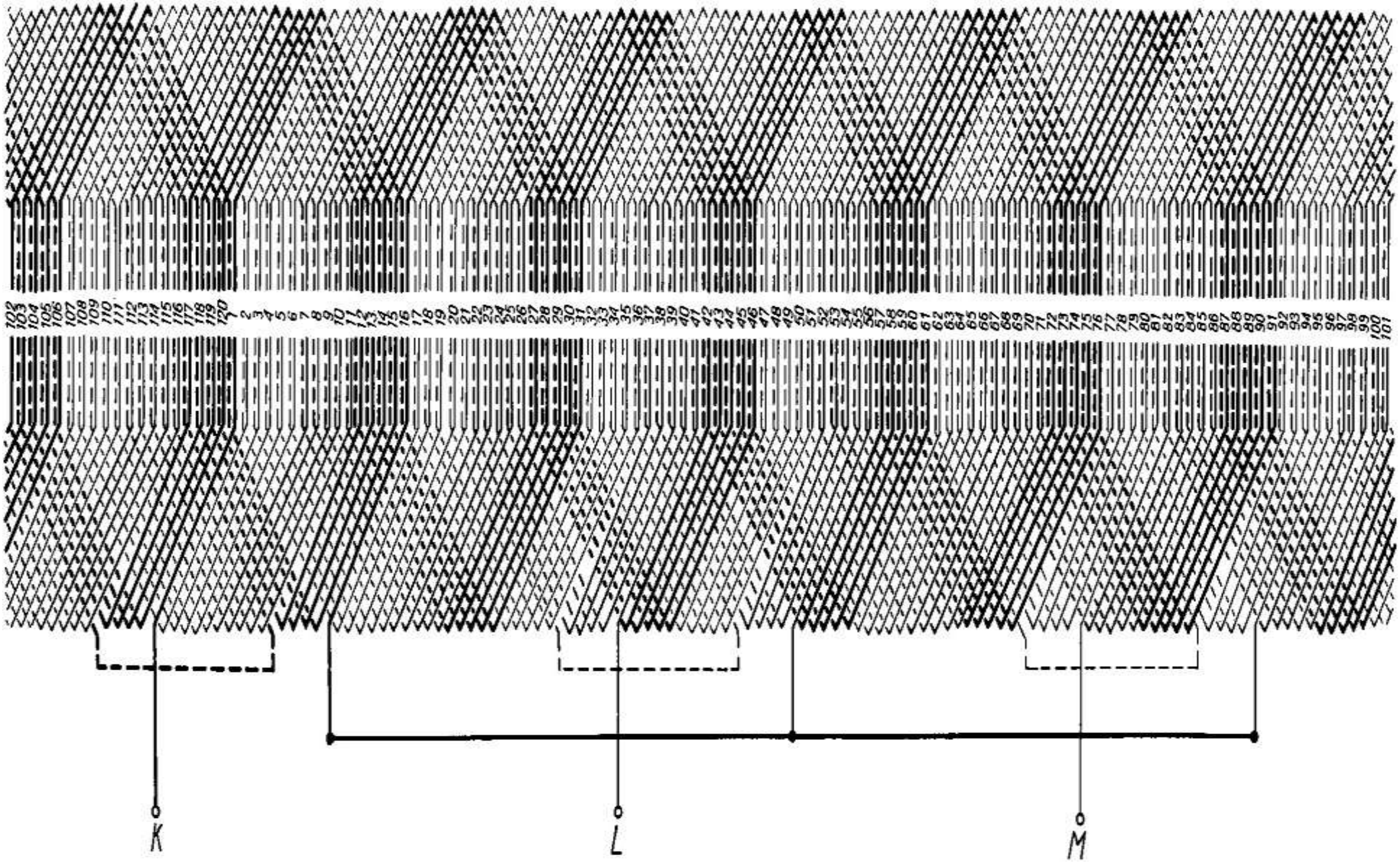


Figure. 137. Rotor Winding (Wave)
Slots = 120; Poles = 8; y= 15; q = 5

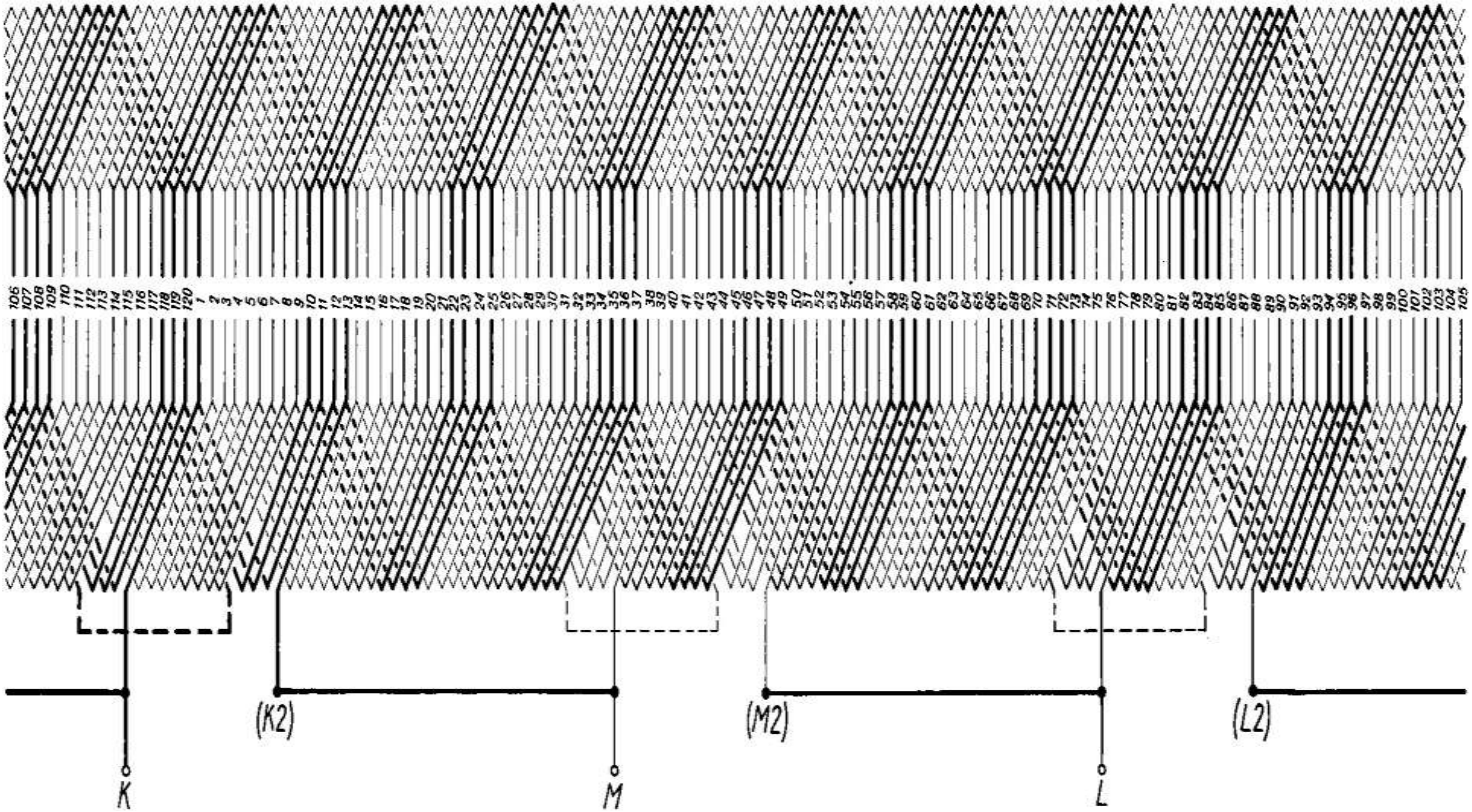


Figure. 138. Rotor Winding (Wave) (joined in delta)
Slots = 120; Poles =10; y= 12; q = 4

Winding of two-speed Windings

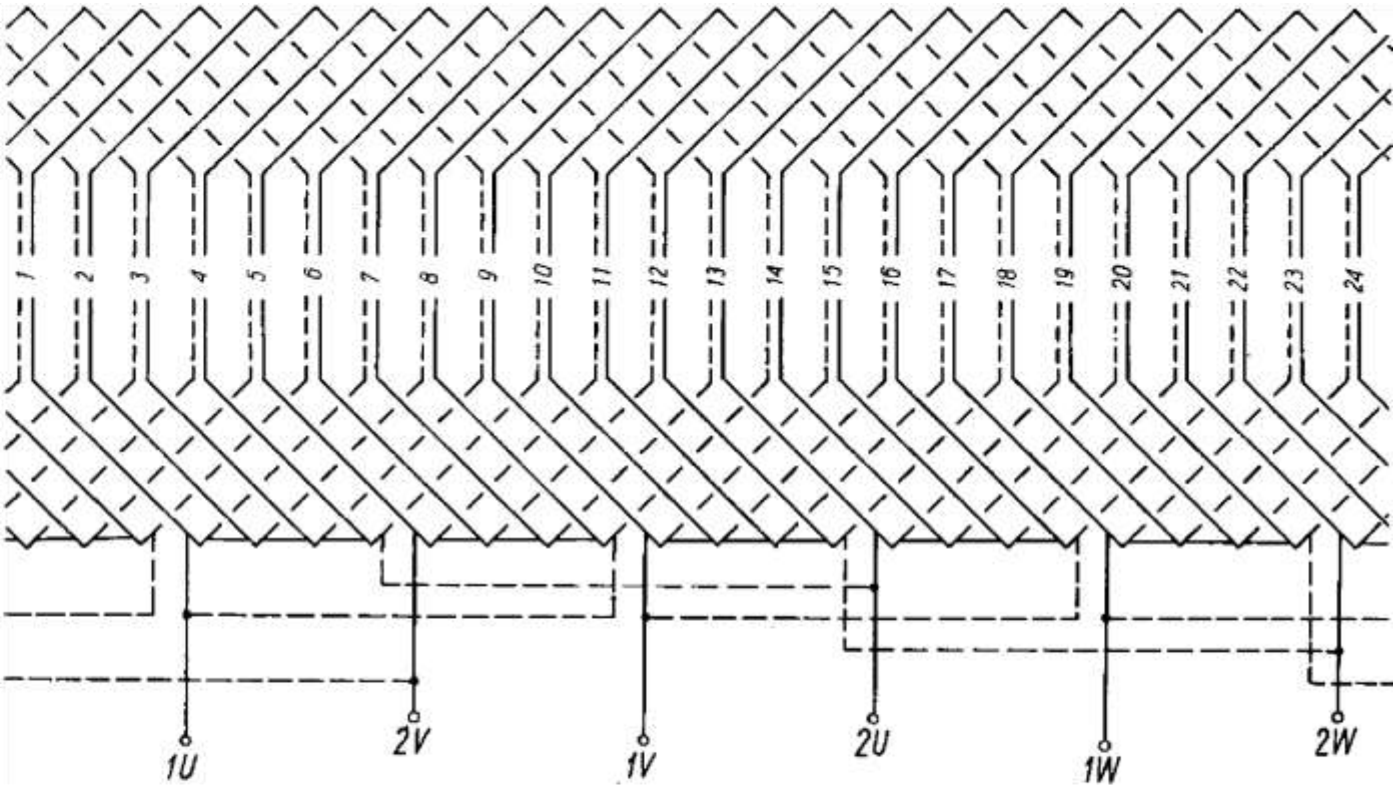


Figure. 139. Double Layer Lap Two-speed Winding
Slots = 24; Poles = 4 / 2; y = 6; q = 4

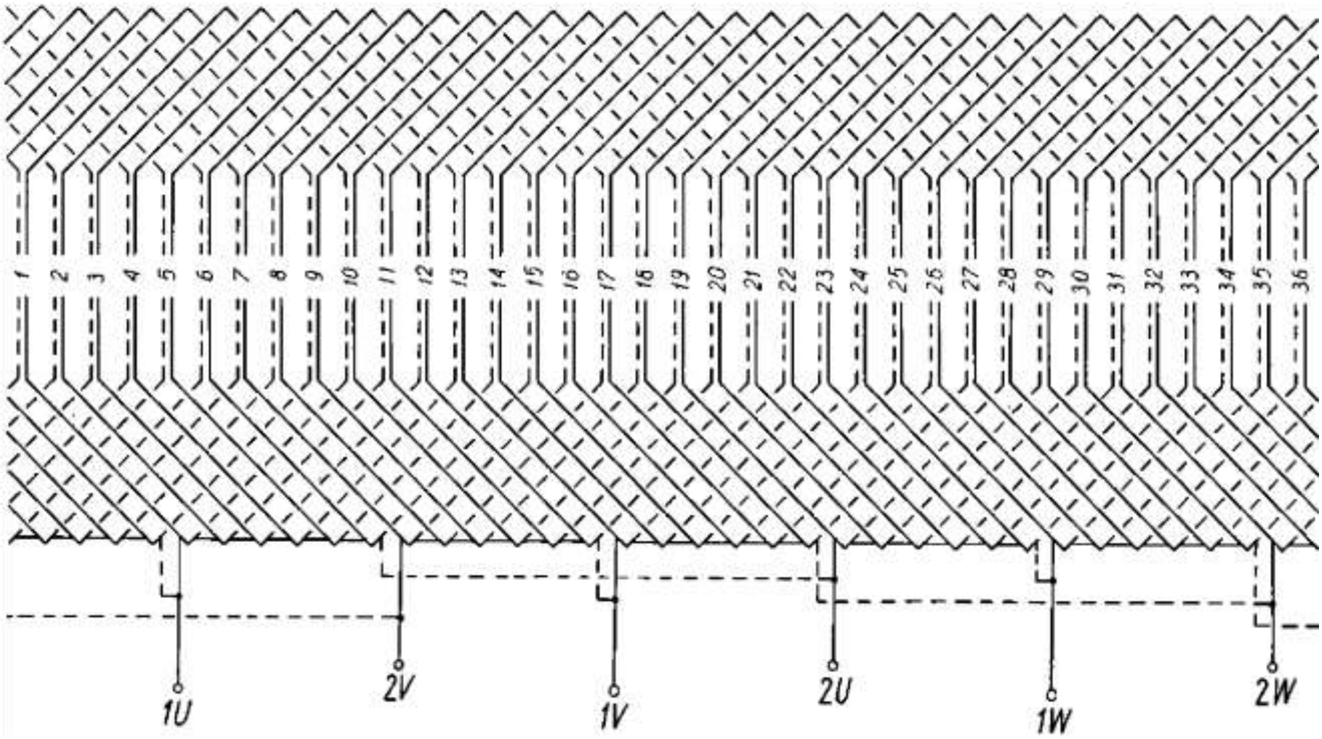


Figure. 140. Double Layer Lap Two-speed Winding
Slots = 36; Poles = 4 / 2, y = 9; q = 6

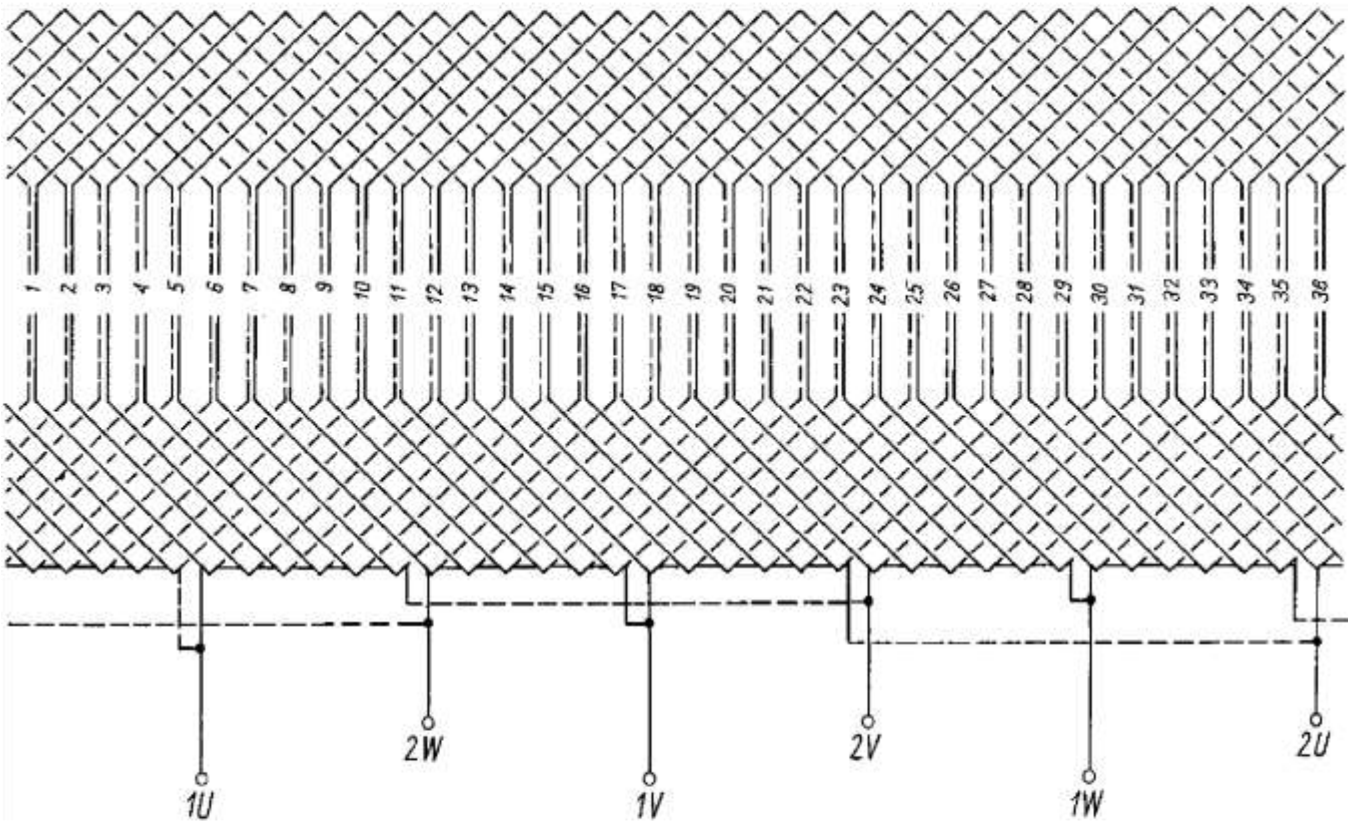


Figure. 140a. Double Layer Lap Two-speed Winding
Slots = 36; Poles = 4 / 2; y = 10; q = 6

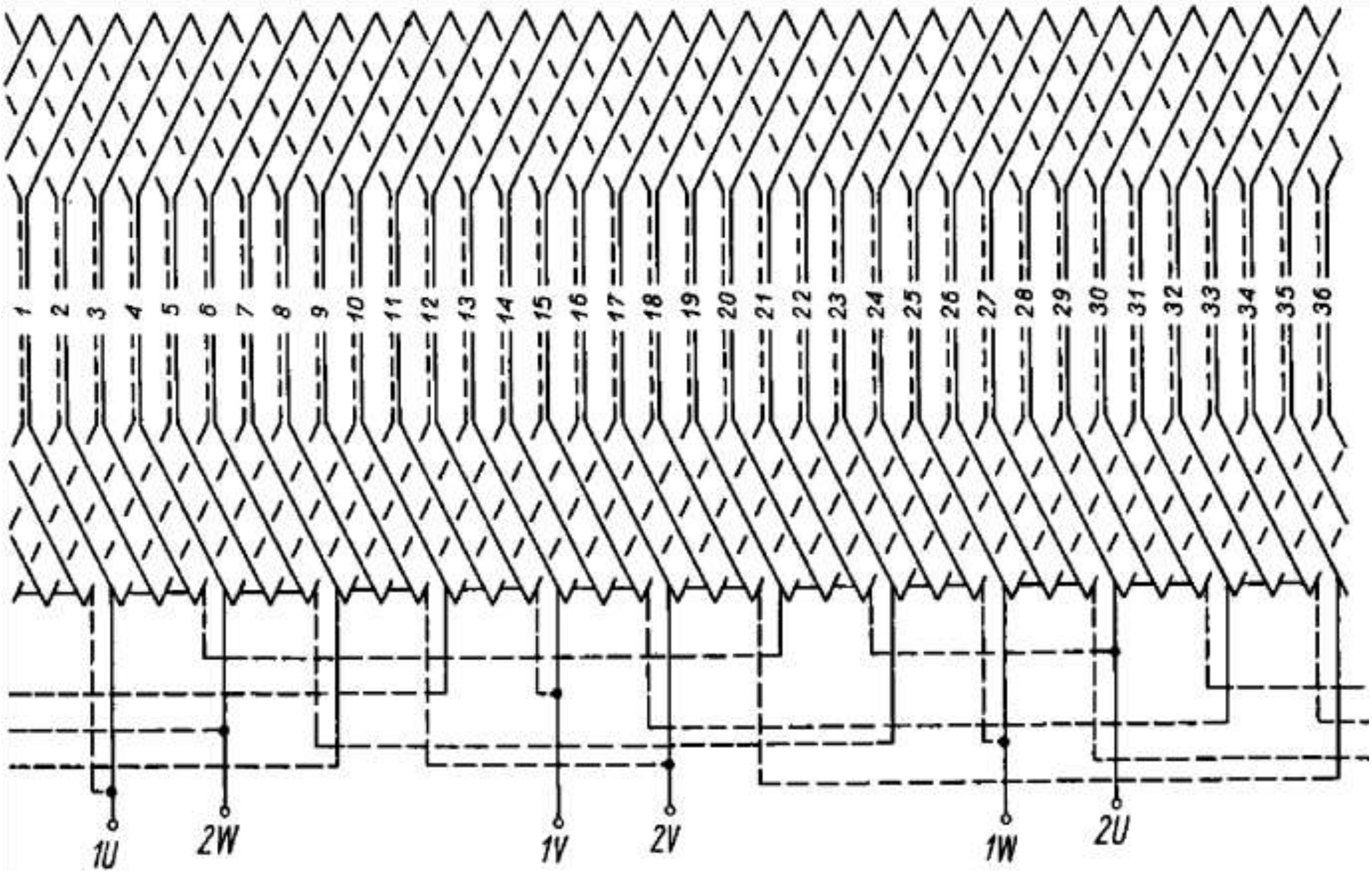


Figure. 141. Double Layer Lap Two-speed Winding
Slots = 36; Poles = 8 / 4; y = 5; q = 3

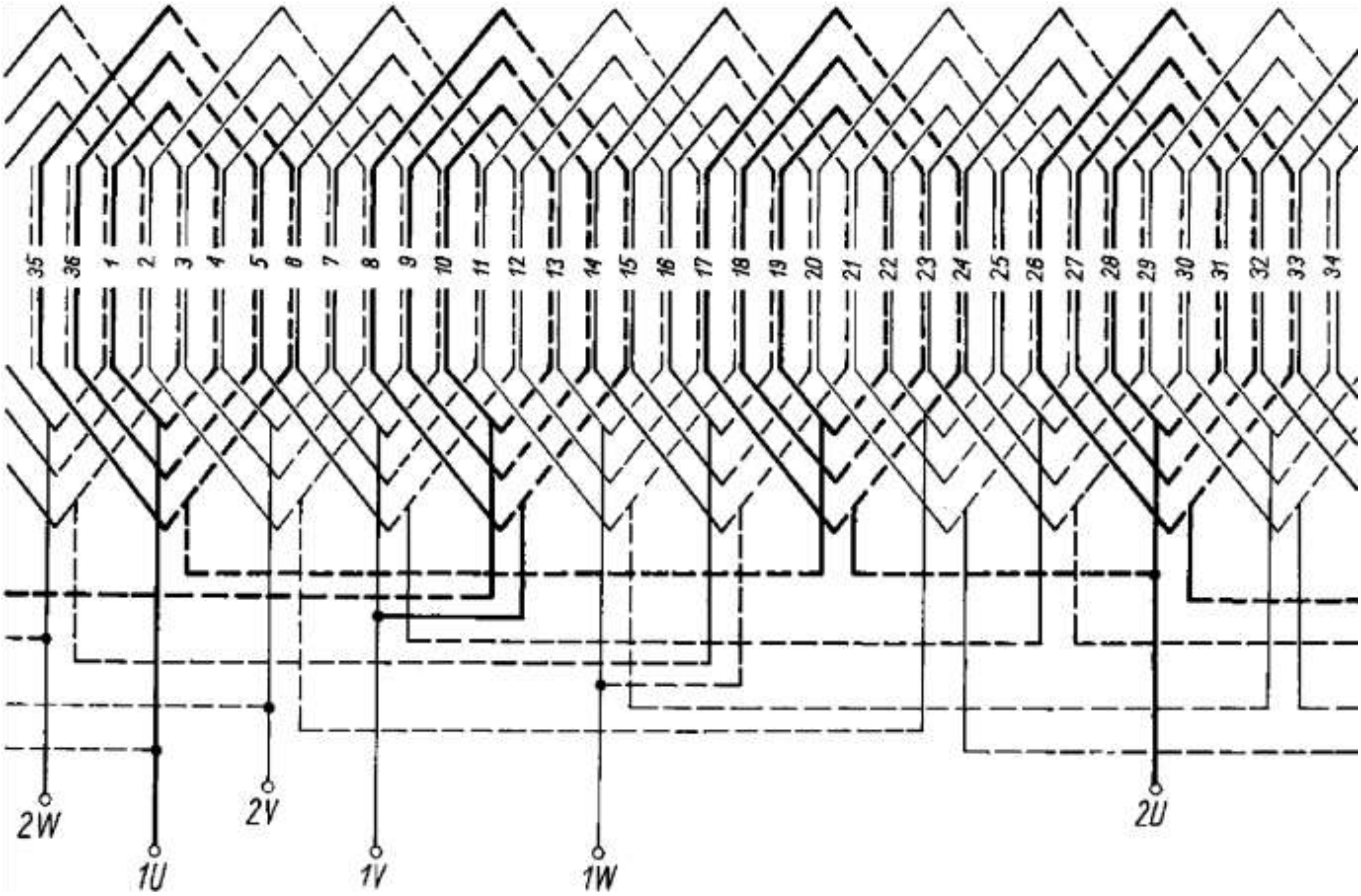


Figure. 141a. Concentric Double Layer Two-speed Winding
Slots = 36; Poles = 8 / 4; y = 3, 5, 7; q = 3

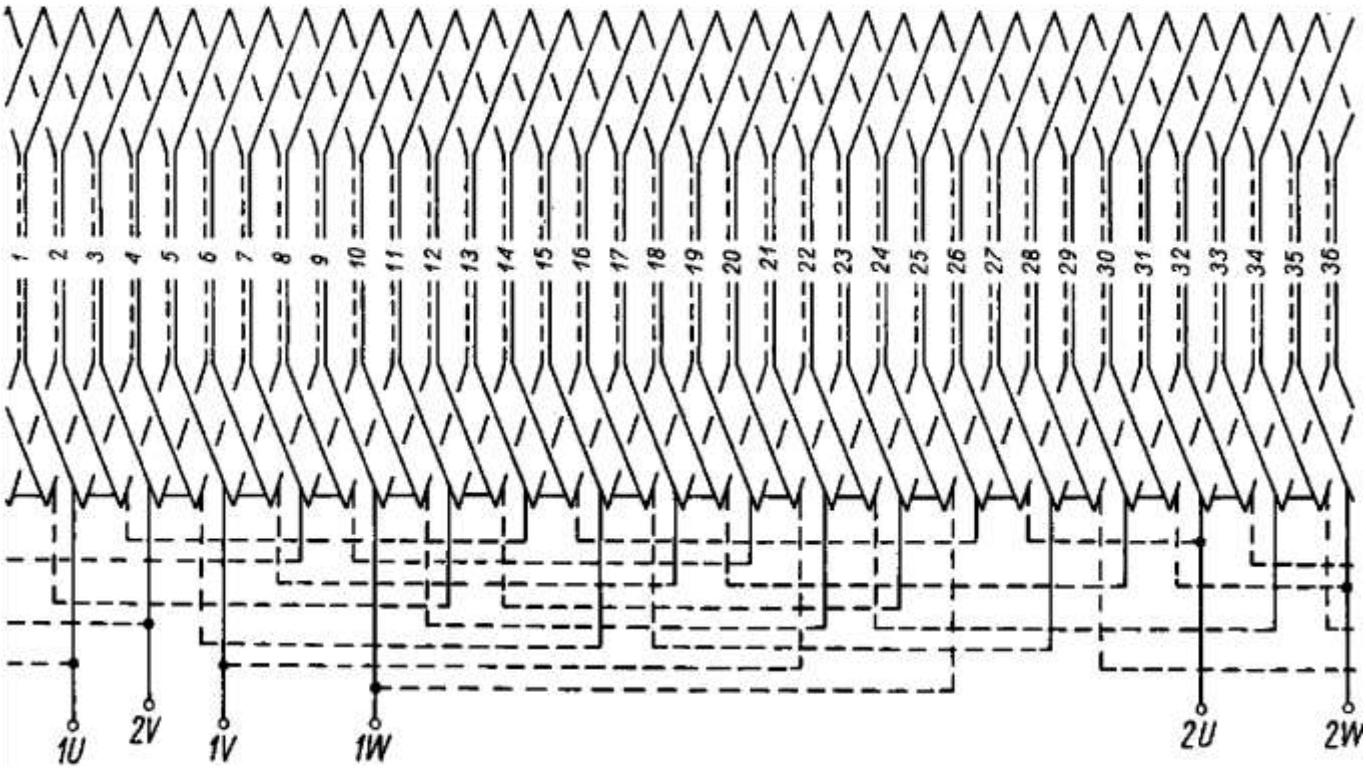


Figure. 142. Double Layer Lap Two-speed Winding
Slots = 36; Poles = 12 / 6; y = 3; q = 2

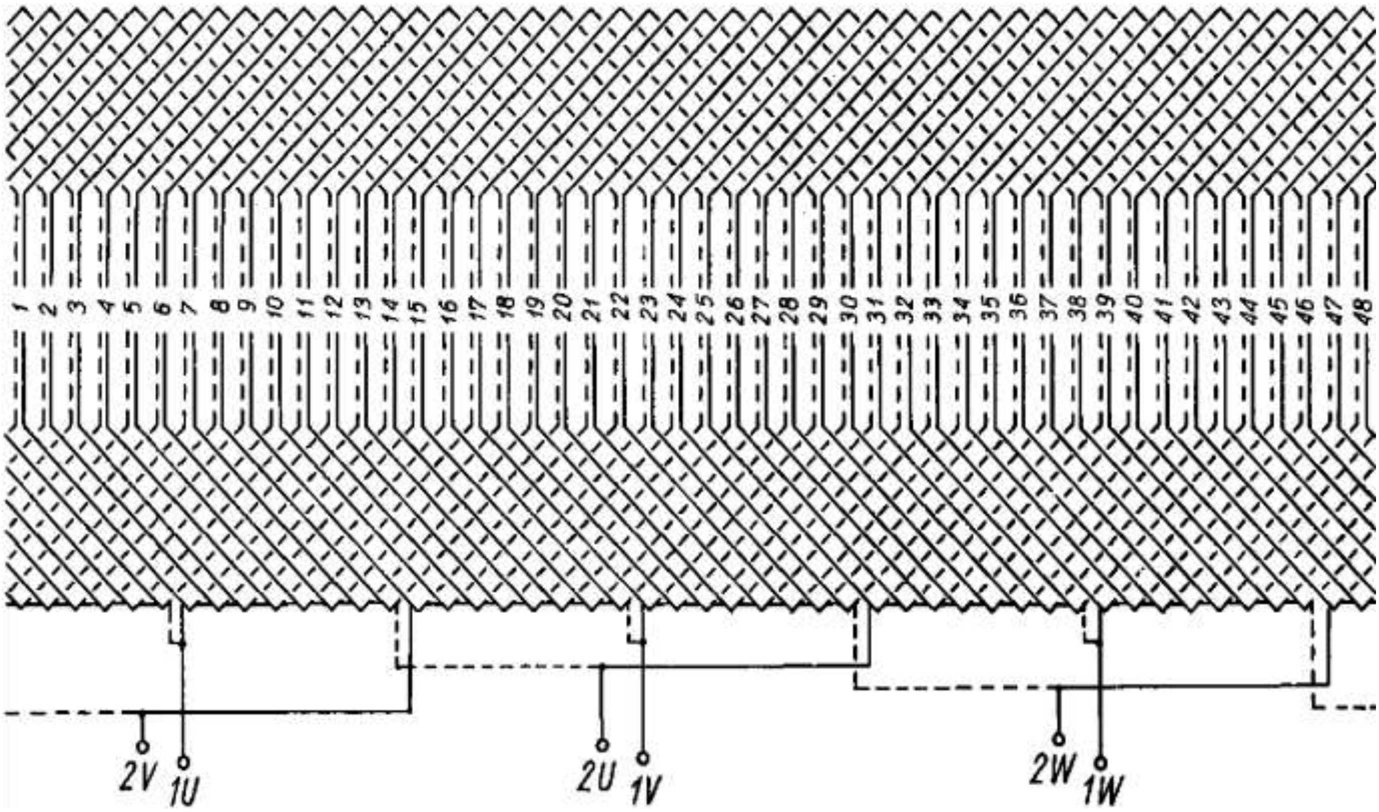


Figure. 143. Double Layer Lap Two-speed Winding
Slots = 48; Poles = 4 / 2; y=12; q = 8

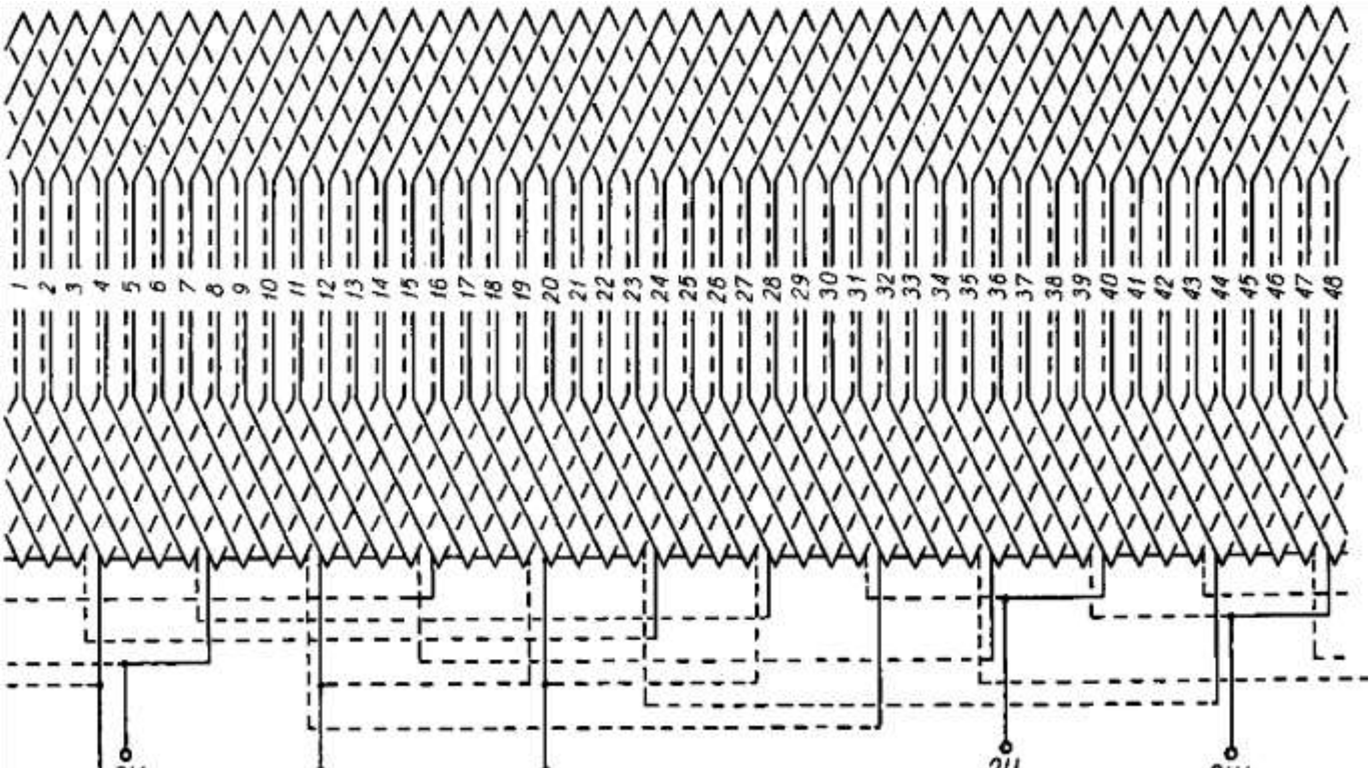
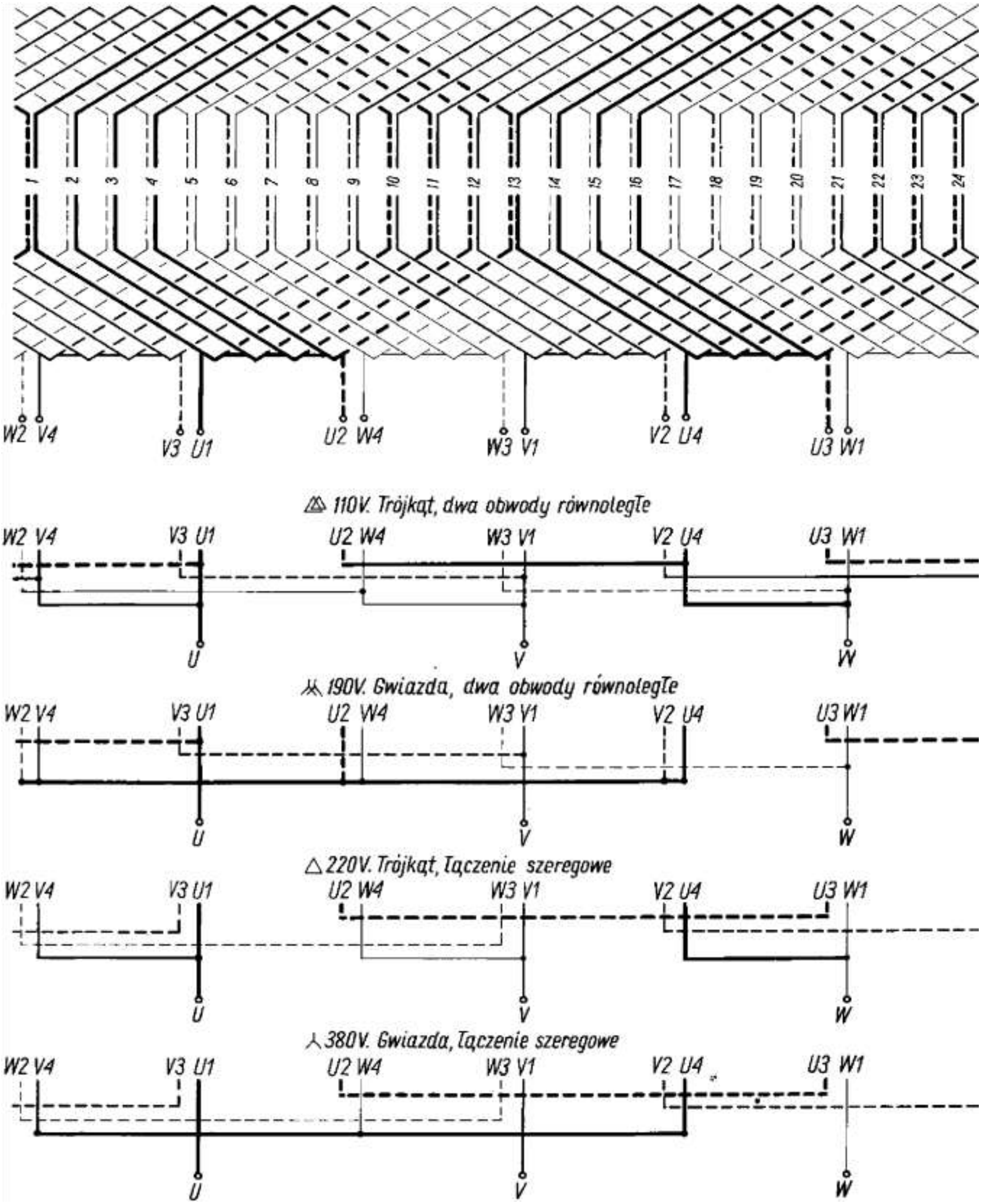


Figure. 144. Double Layer Lap Two-speed Winding
Slots = 48; Poles = 8 / 4; y = 6; q = 4

Multi-voltage Winding


1
2
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15
16
17
18
19
20
21
22
23
24
W2 V4
V3 U1
U2 W4
W3 V1
V2 U4
U3 W1
△ 110V. Trójkąt, dwa obwody równoległe
U
V
W
⅄ 190V. Gwiazda, dwa obwody równoległe
△ 220V. Trójkąt, łączenie szeregowe
⅄ 380V. Gwiazda, łączenie szeregowe

Figure. 145. Double Layer Lap Winding Multi-Voltage
110 / 190 / 220 / 380 Volt. Slots = 24; Poles = 2; y = 9; q = 4

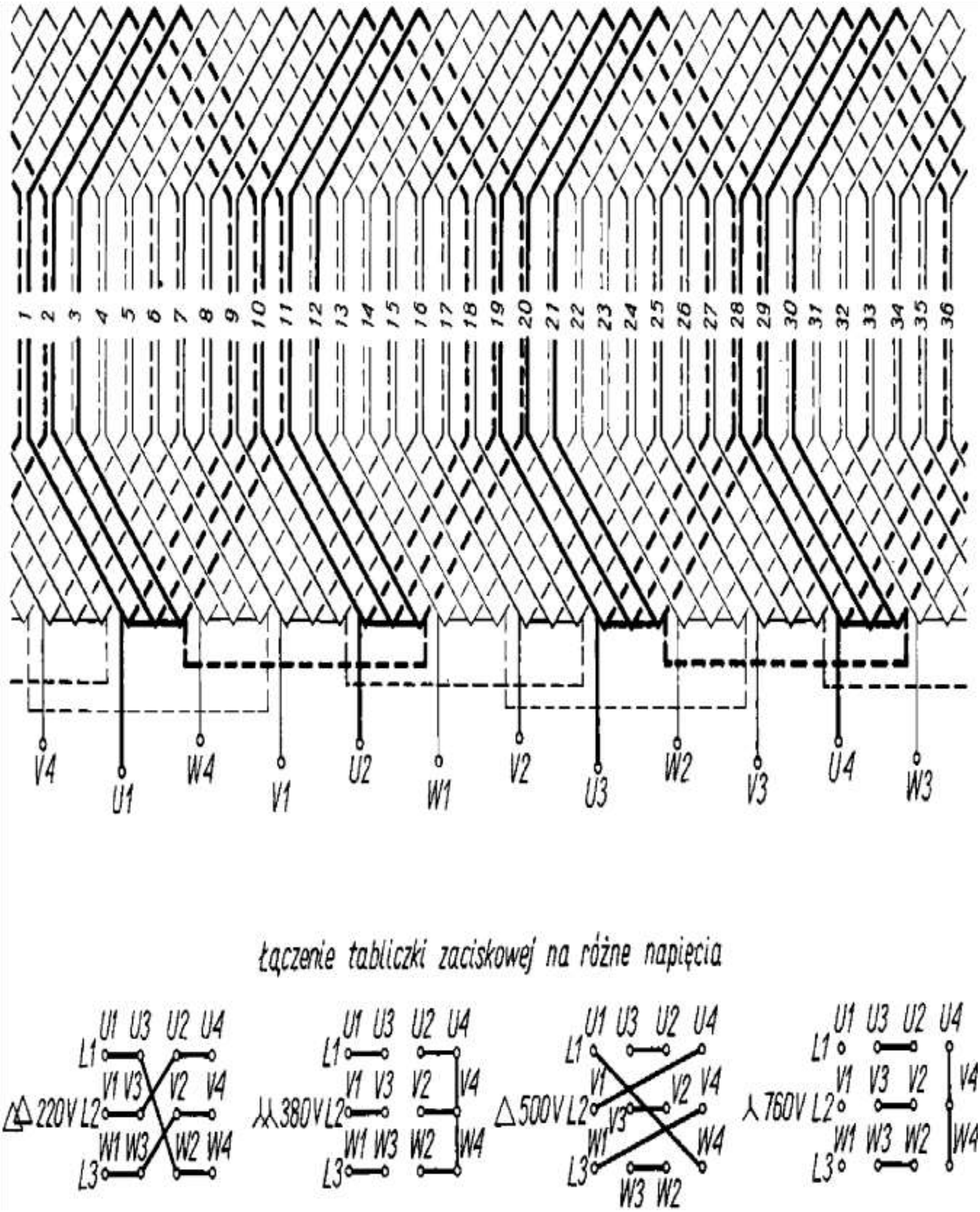

Figure. 146. Double Layer Lap Winding Multi-Voltage
220 / 380 / 500 / 760 Volt
Slots = 36; Poles = 4; y = 8; q = 3

Single Phase Winding

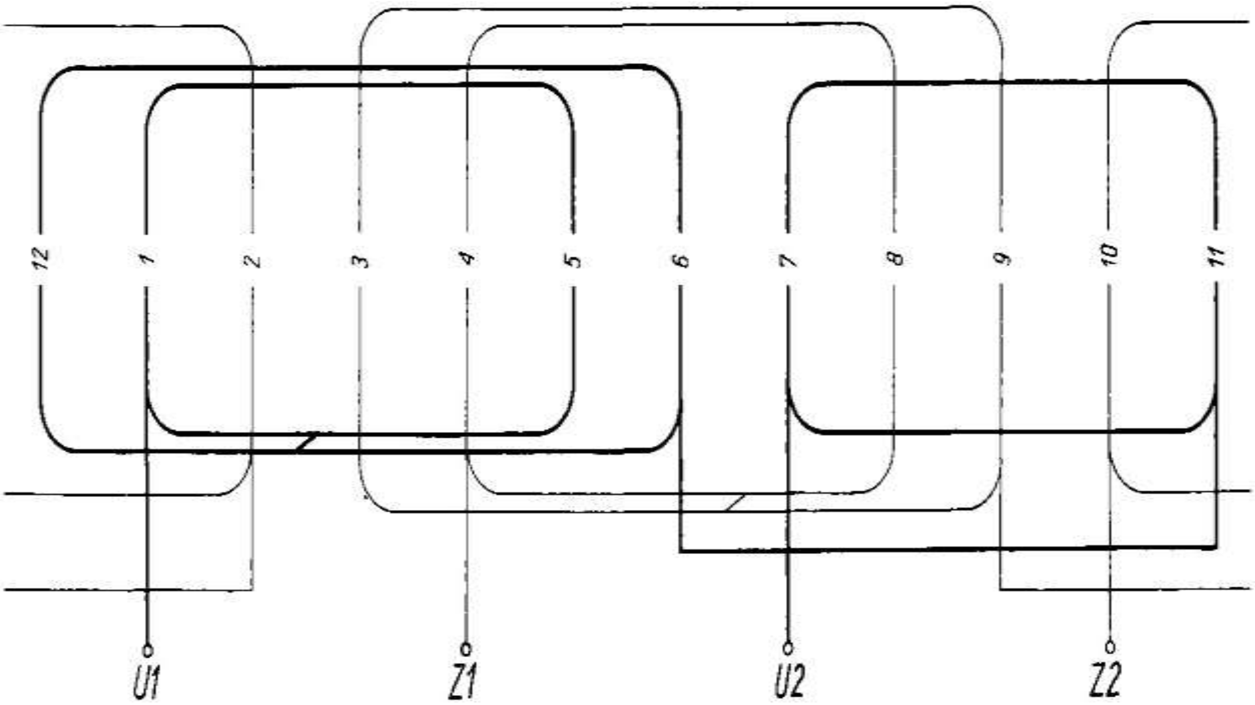

Figure. 147. Two-Tier Single-Phase Winding
Slots= 12; Poles= 2; y = 4, 6; q = 3

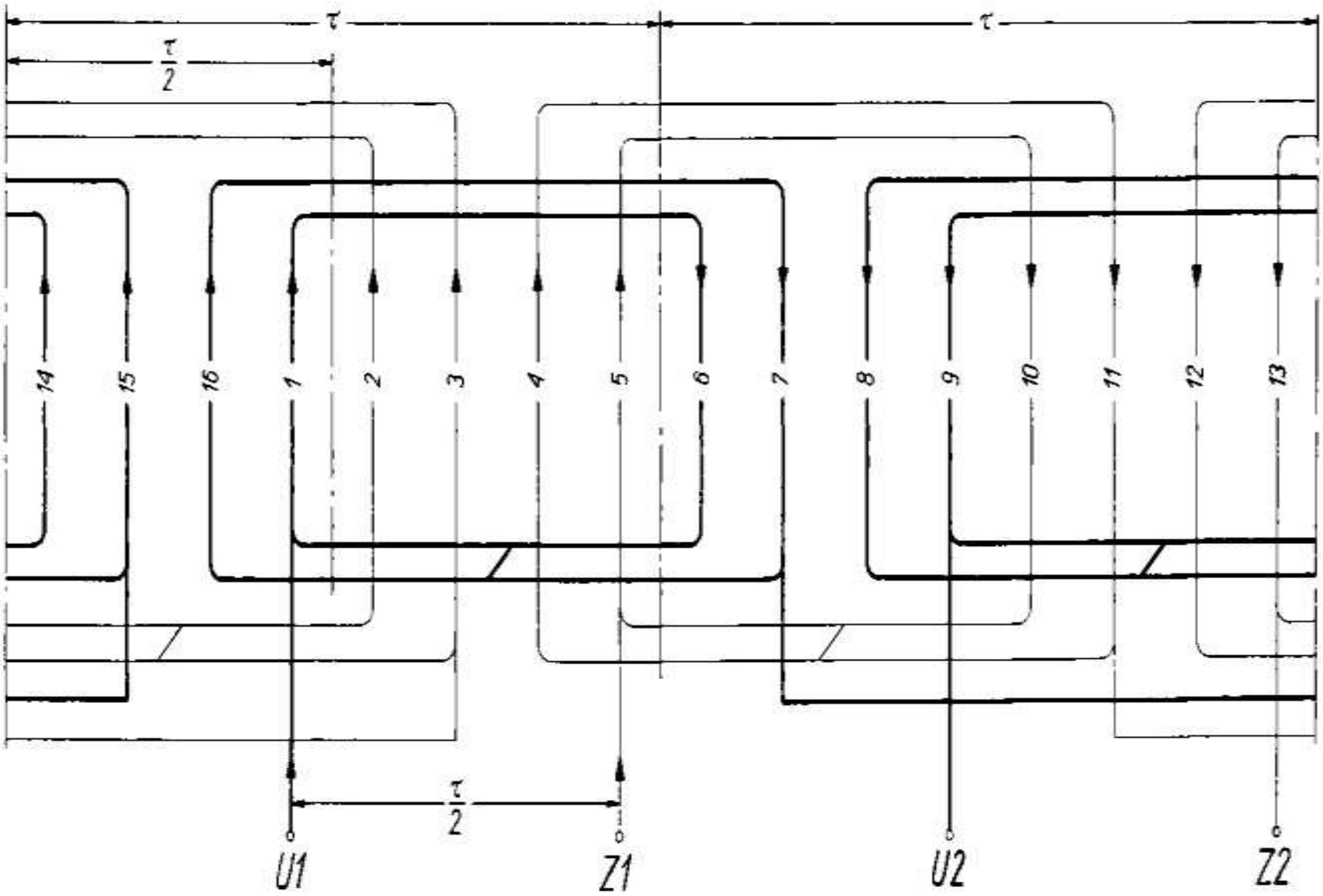

Figure. 148. Two Tier, Single Phase Winding
Slots = 16; Poles = 2; y = 5, 7; q = 4

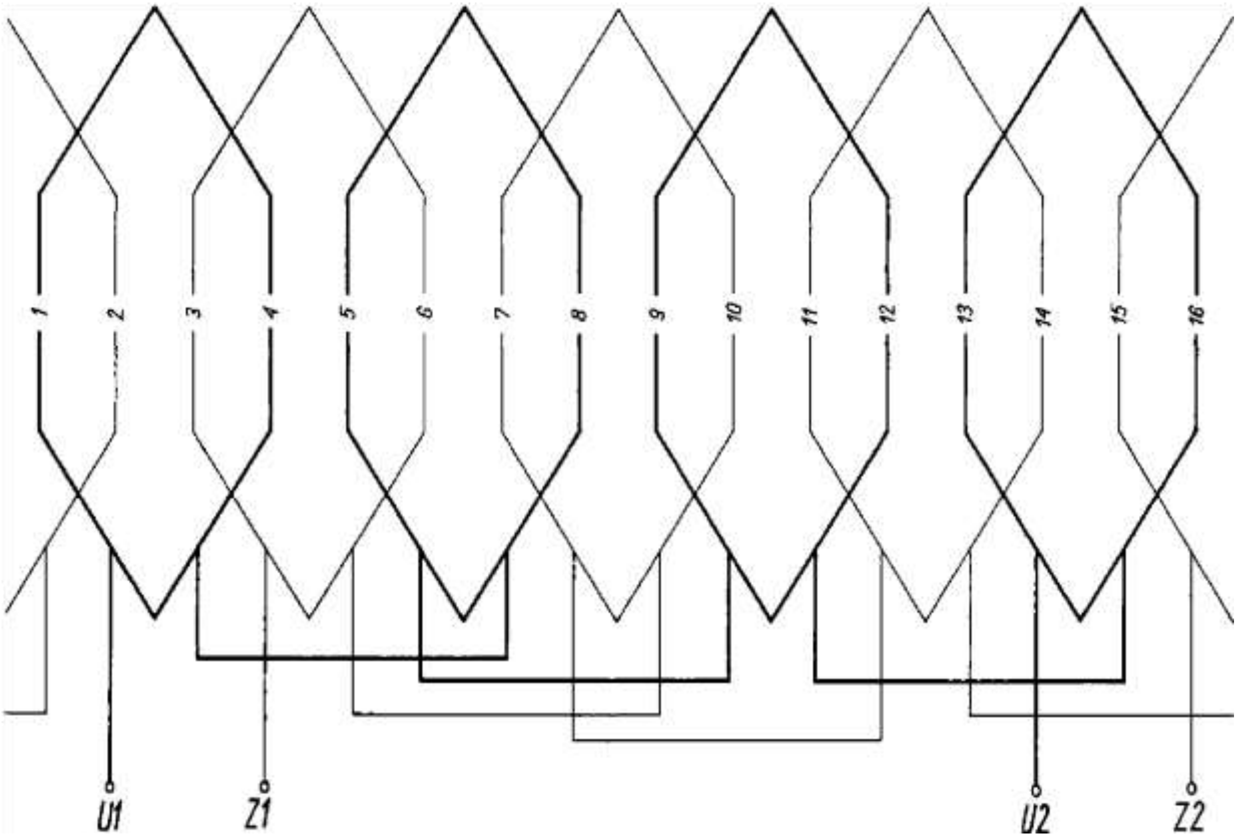

Figure. 149. Basket Single Phase Winding
Slots = 16; Poles = 4; y = 3; q = 2

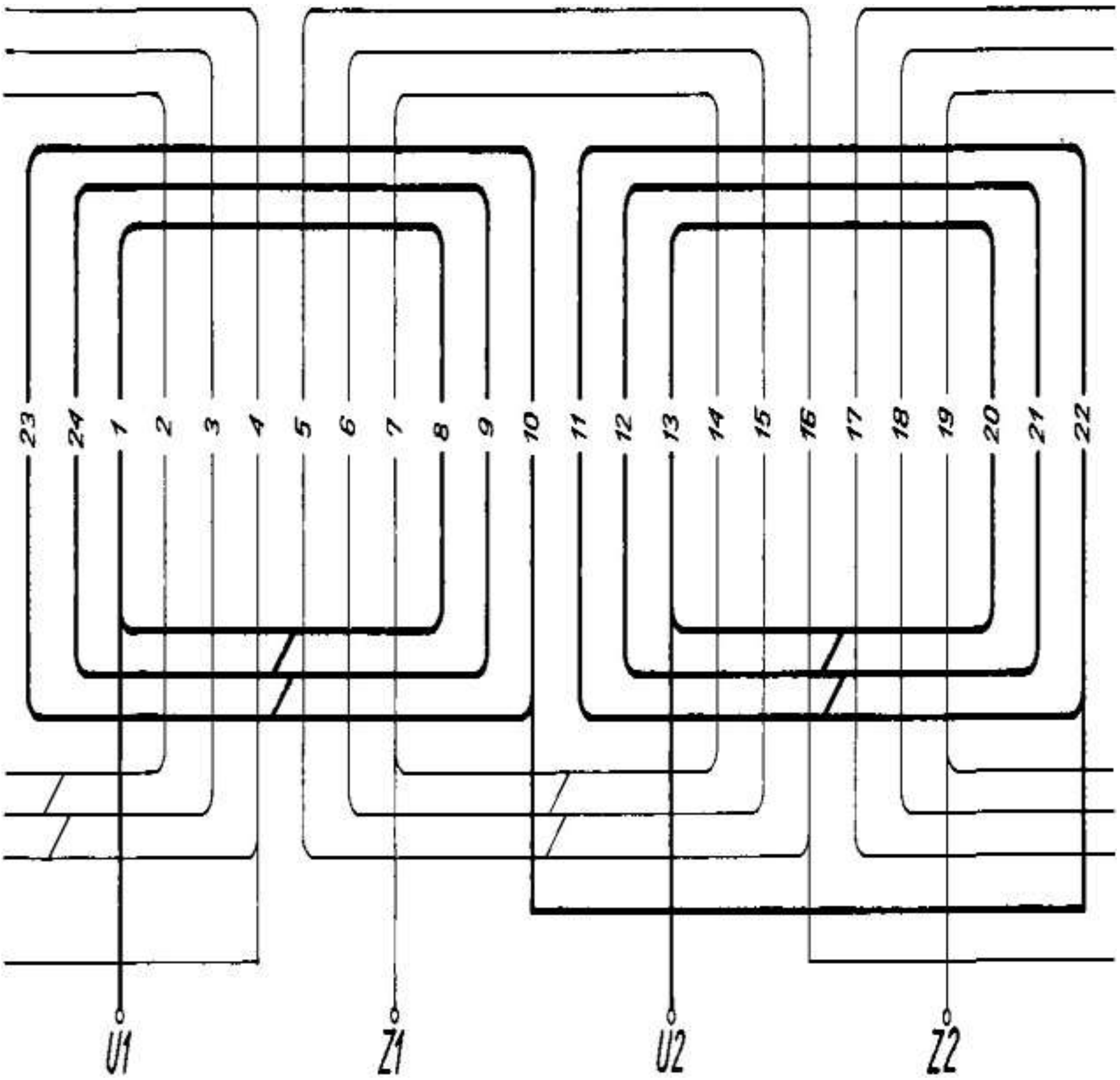

Figure. 150. Two Tier, Single Phase Winding
Slots = 24; Poles = 2; y = 7, 9, 11; q = 6

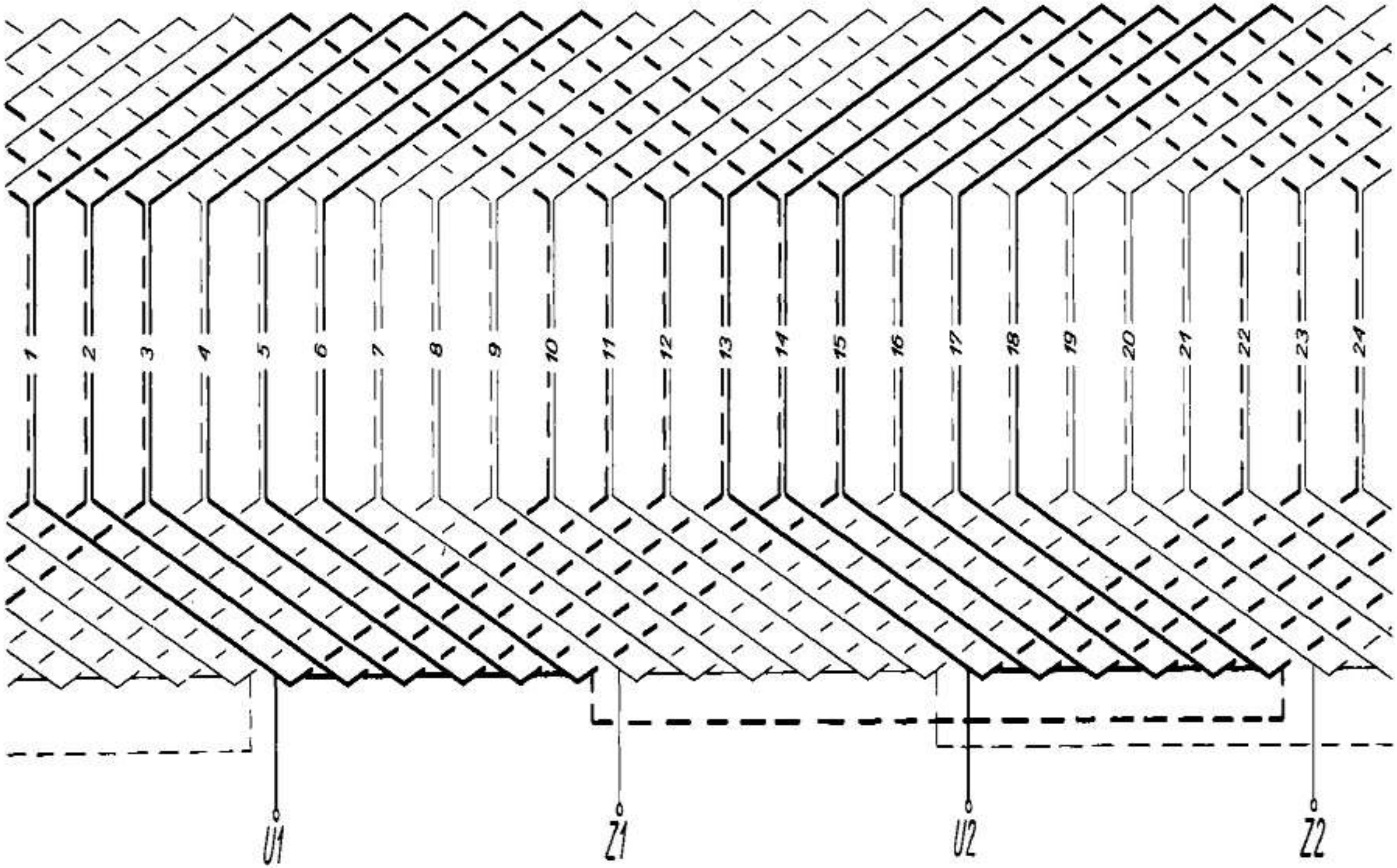

Figure. 151. Double-Layer Lap Single Phase Winding
Slots = 24; Poles = 2; y = 9; q = 6

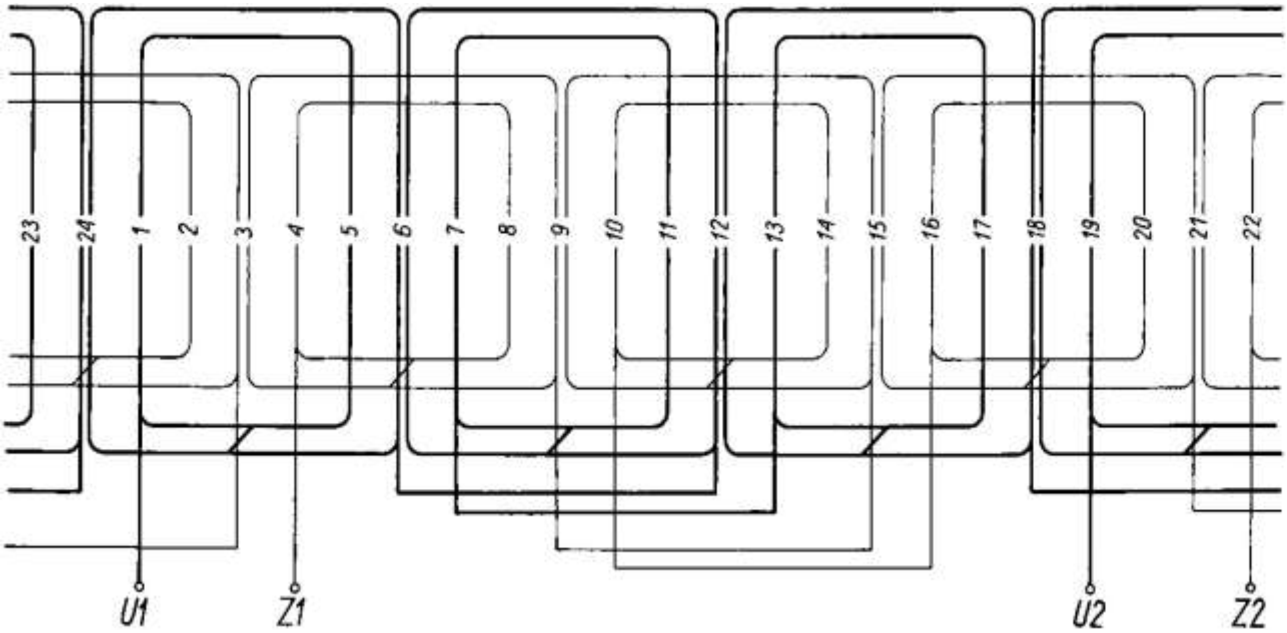

Figure. 152. Two Tier, Single Phase Winding (Shared Outer Slots)
Slots = 24; Poles = 4; y = 4, 6; q = 3

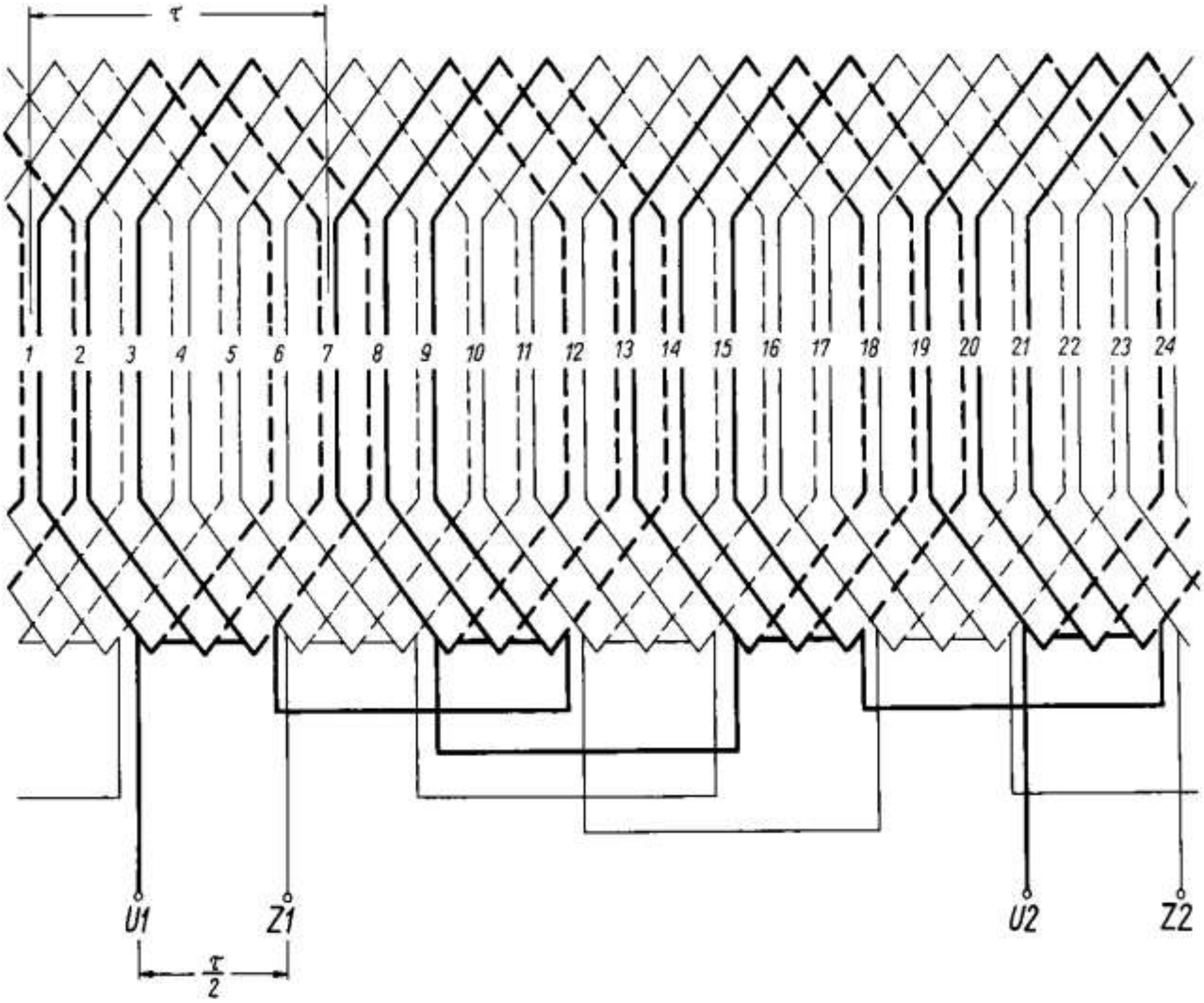

Figure. 153. Double-Layer Lap Single Phase Winding
Slots = 24; Poles = 4; y = 5; q = 3

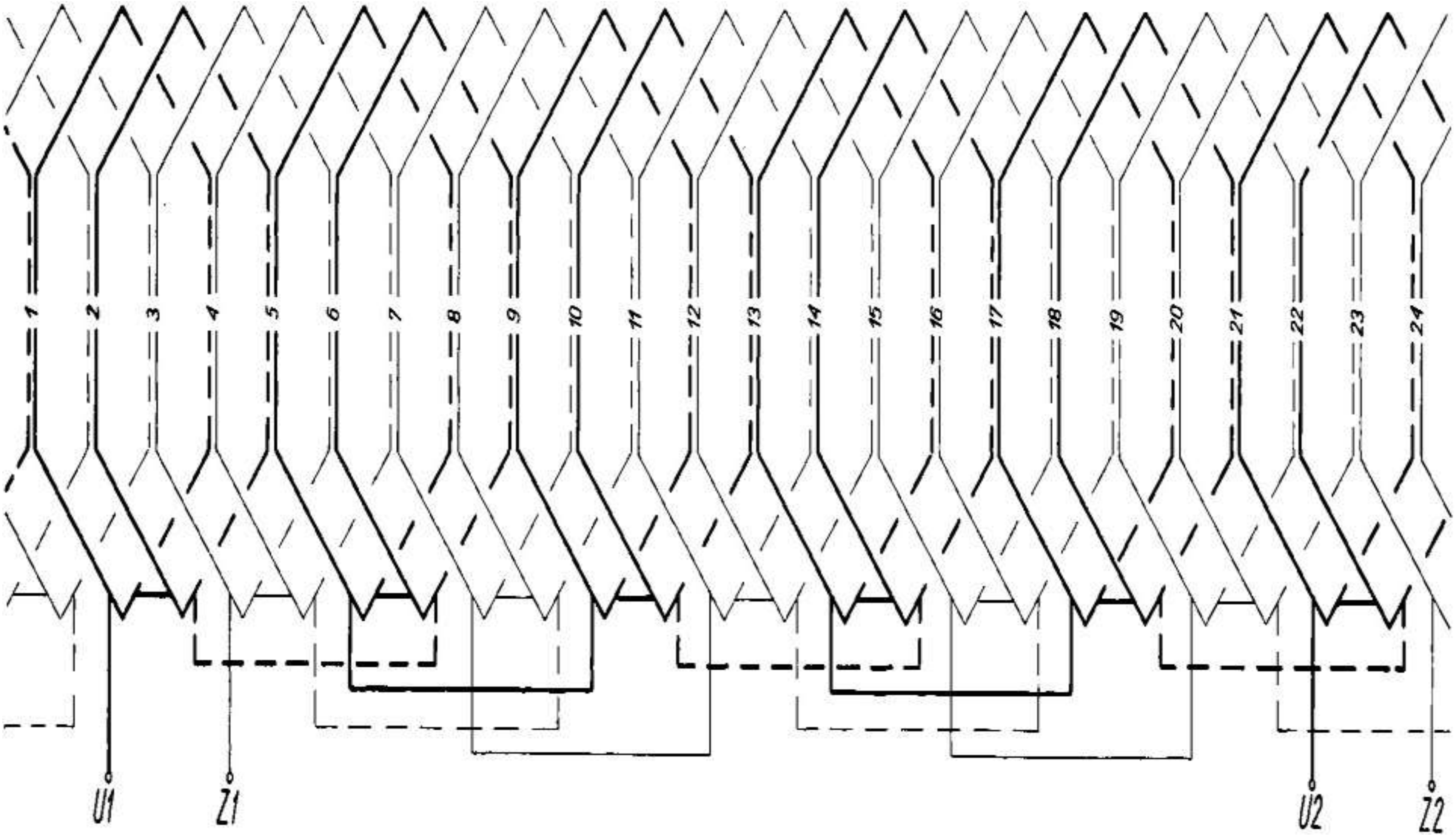

Figure. 154. Double-Layer Lap Single Phase Winding
Slots = 24; Poles = 6; y = 3; q = 2

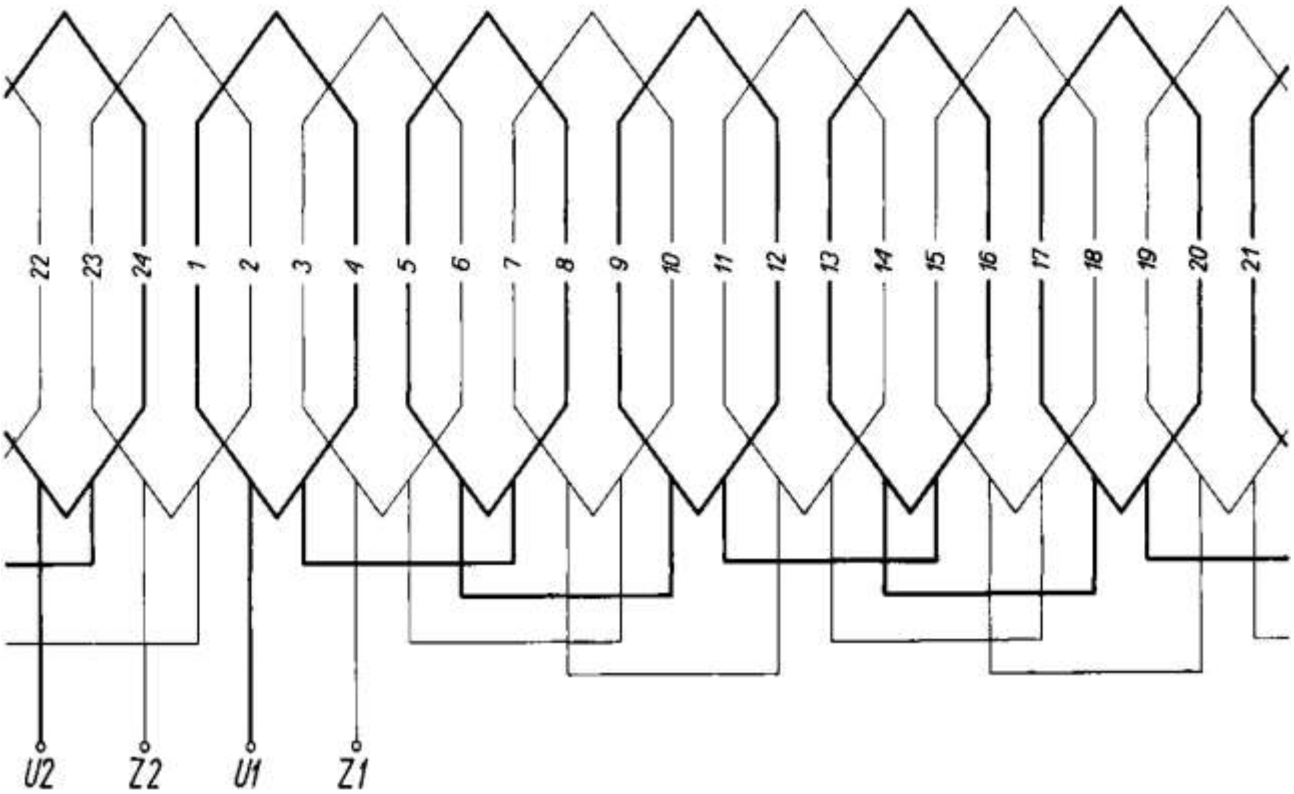

Figure. 155. Basket Single Phase Winding
Slots = 24; Poles = 6; y = 3; q = 2

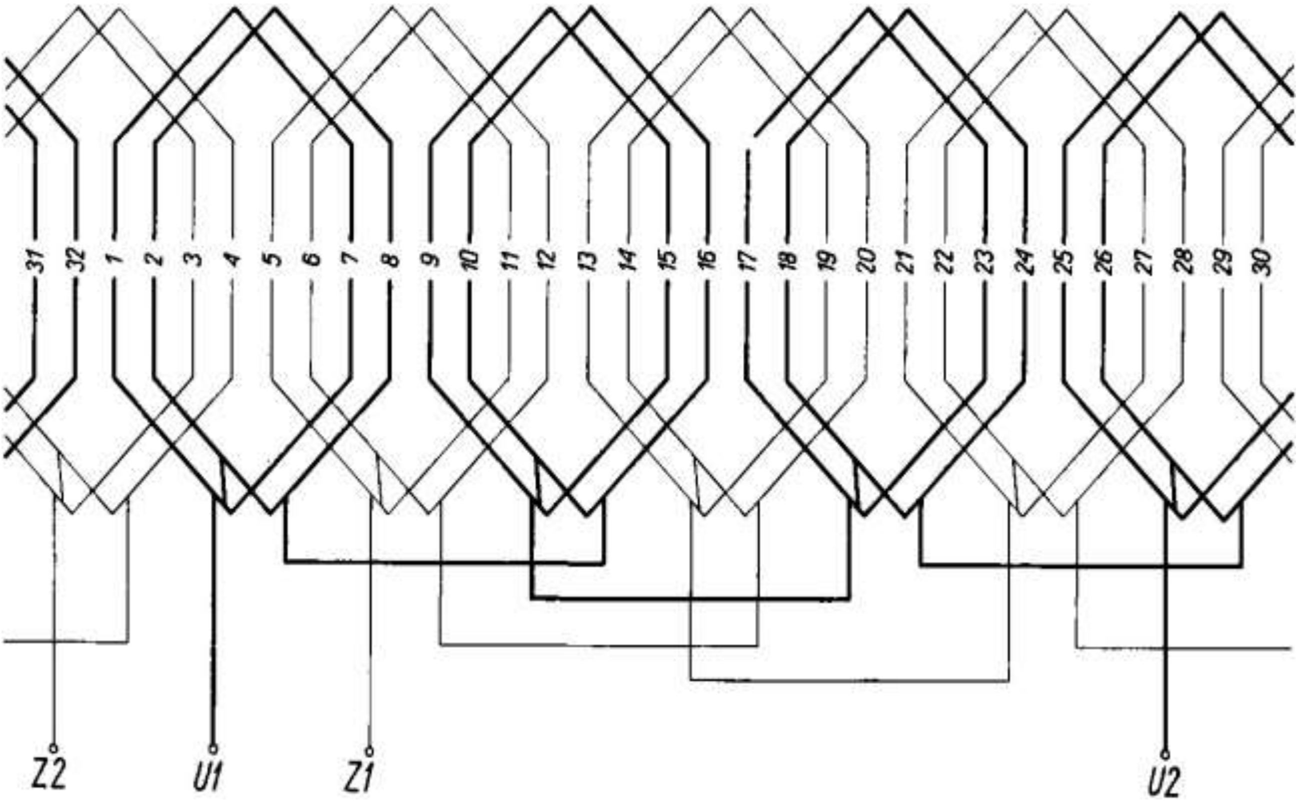

Figure. 156. Chain Group Single Phase Winding
Slots = 32; Poles = 4; y = 6; q = 4

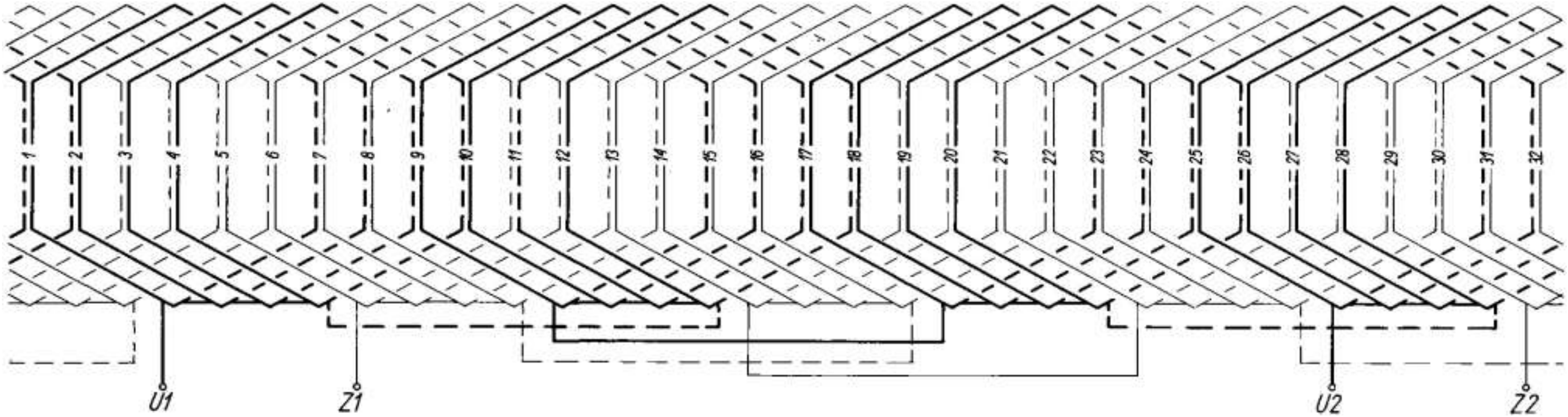

Figure. 157. Double-Layer Lap Single Phase Winding
Slots = 32; Poles = 4; y = 6; q = 4

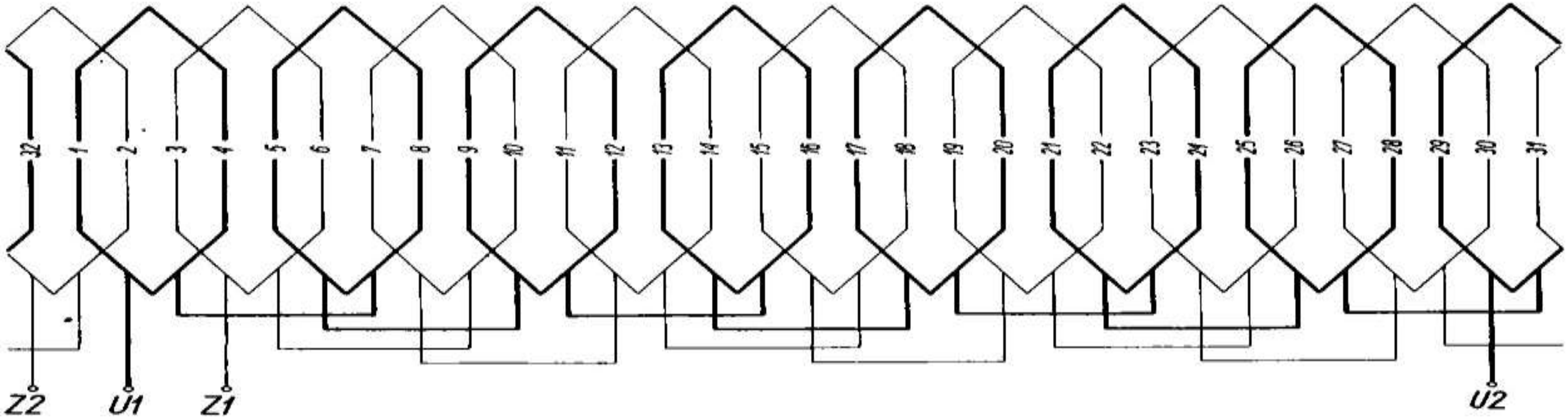

Figure. 158. Basket Single Phase Winding
Slots = 32; Poles = 8; y = 3; q = 2

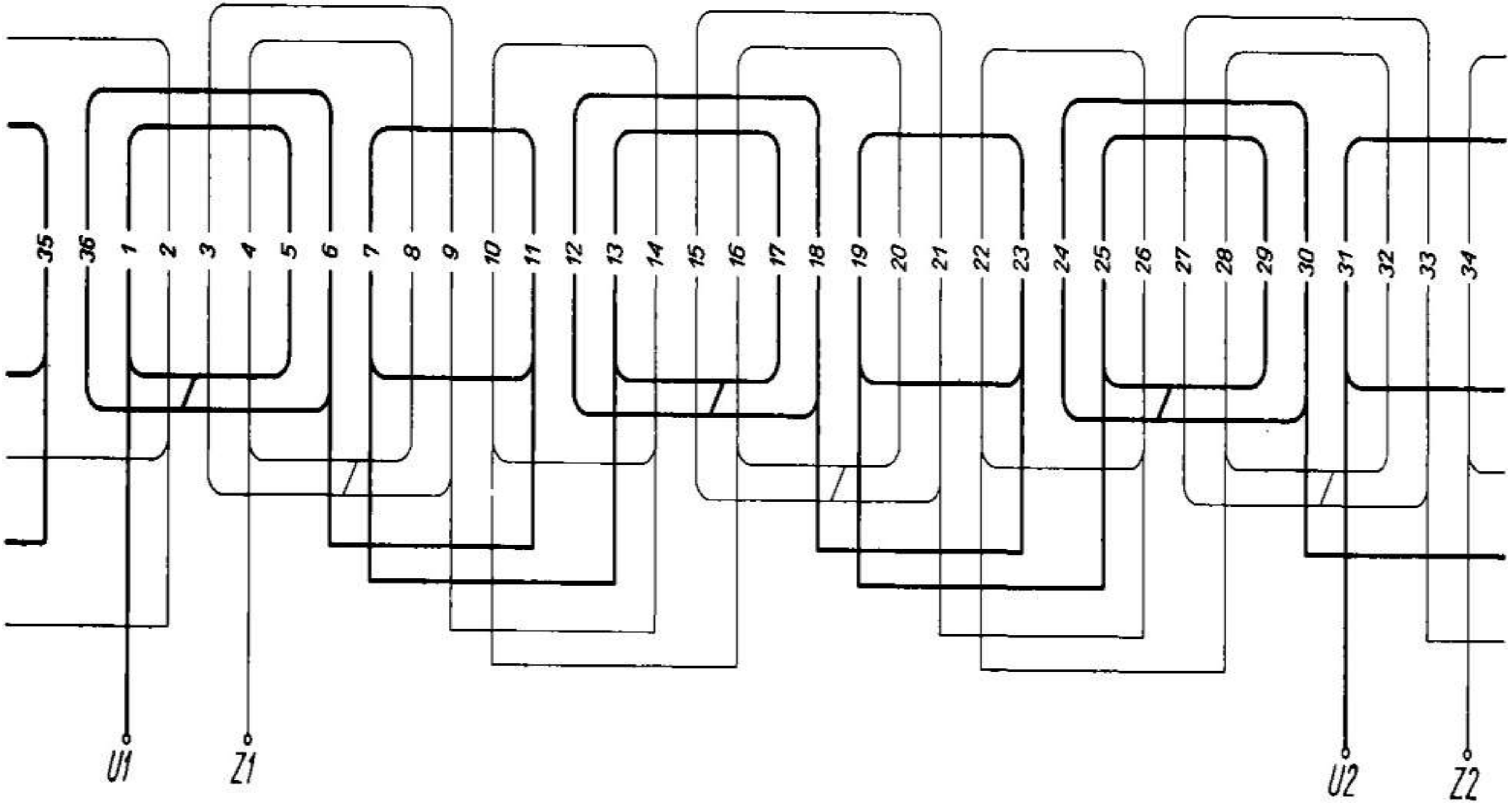

Figure. 159. Two Tier. Single Phase Winding with odd Grouping
Slots = 36; Poles = 6; y = 4, 6; q = 3

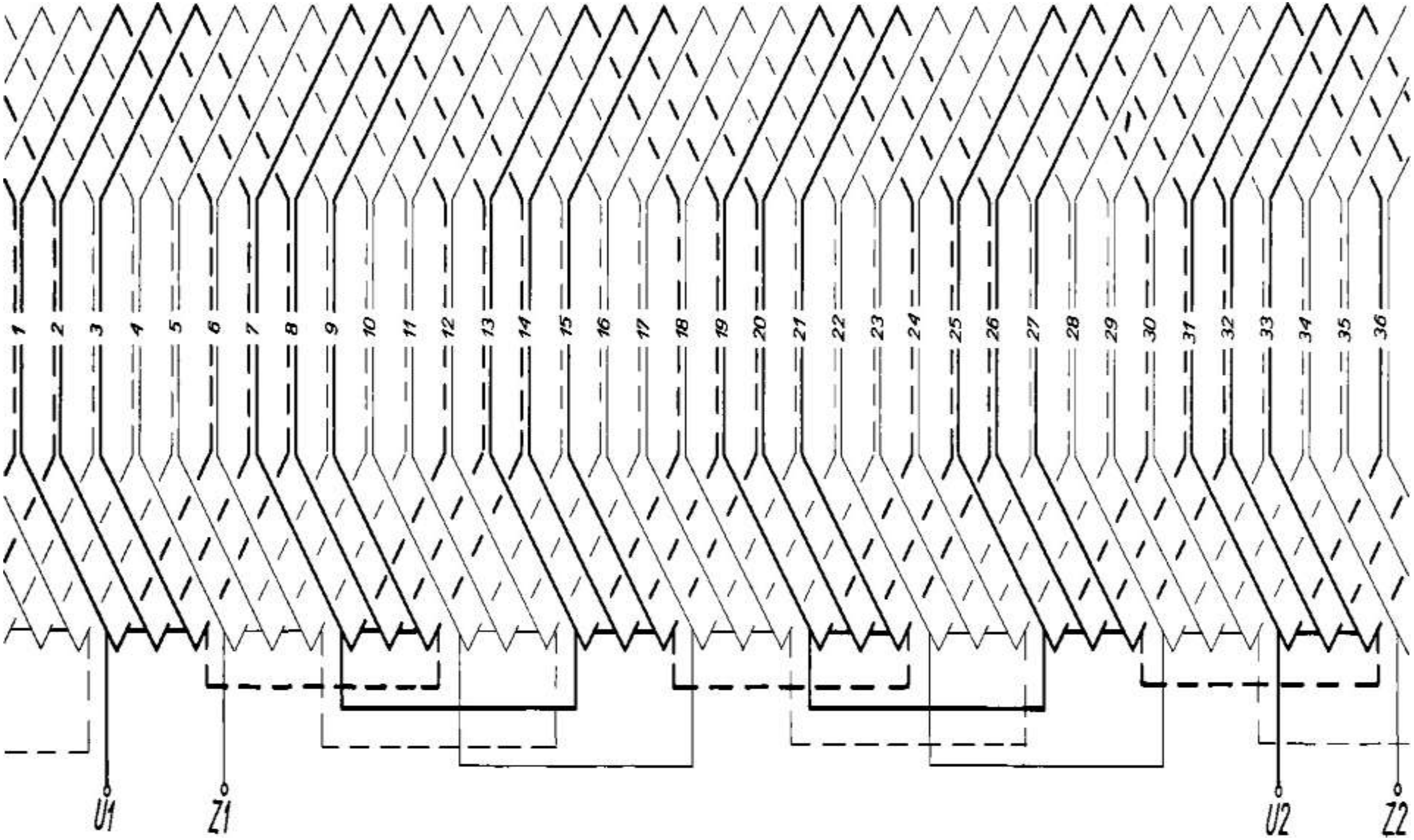

Figure. 160. Double-Layer Lap, Single Phase Winding
Slots = 36; Poles = 6; y = 5; q = 3

3. 2. Unbalanced Single-Phase Winding

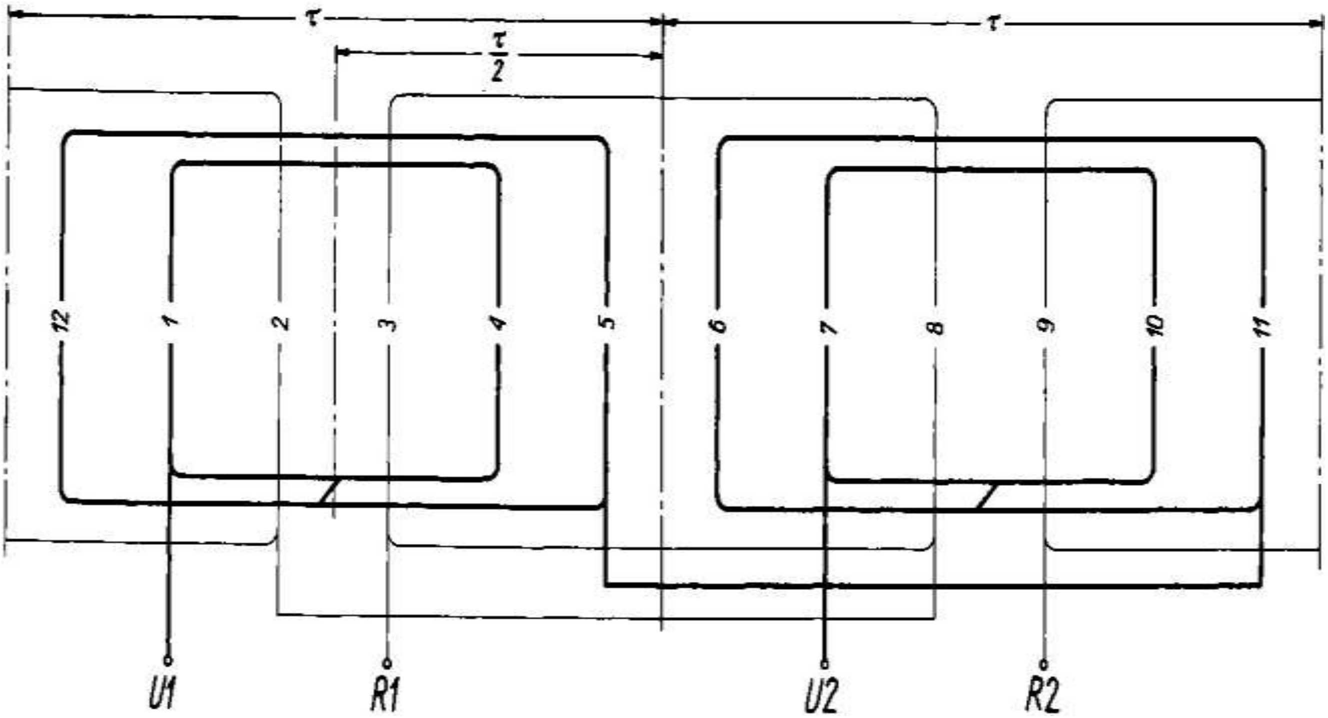

Figure. 161. Unbalanced Two-Tier Single-Phase Winding
Slots = 12; Poles = 2; y_1 = 3, 5; y_2 = 5; q_1 = 4; q_2= 2

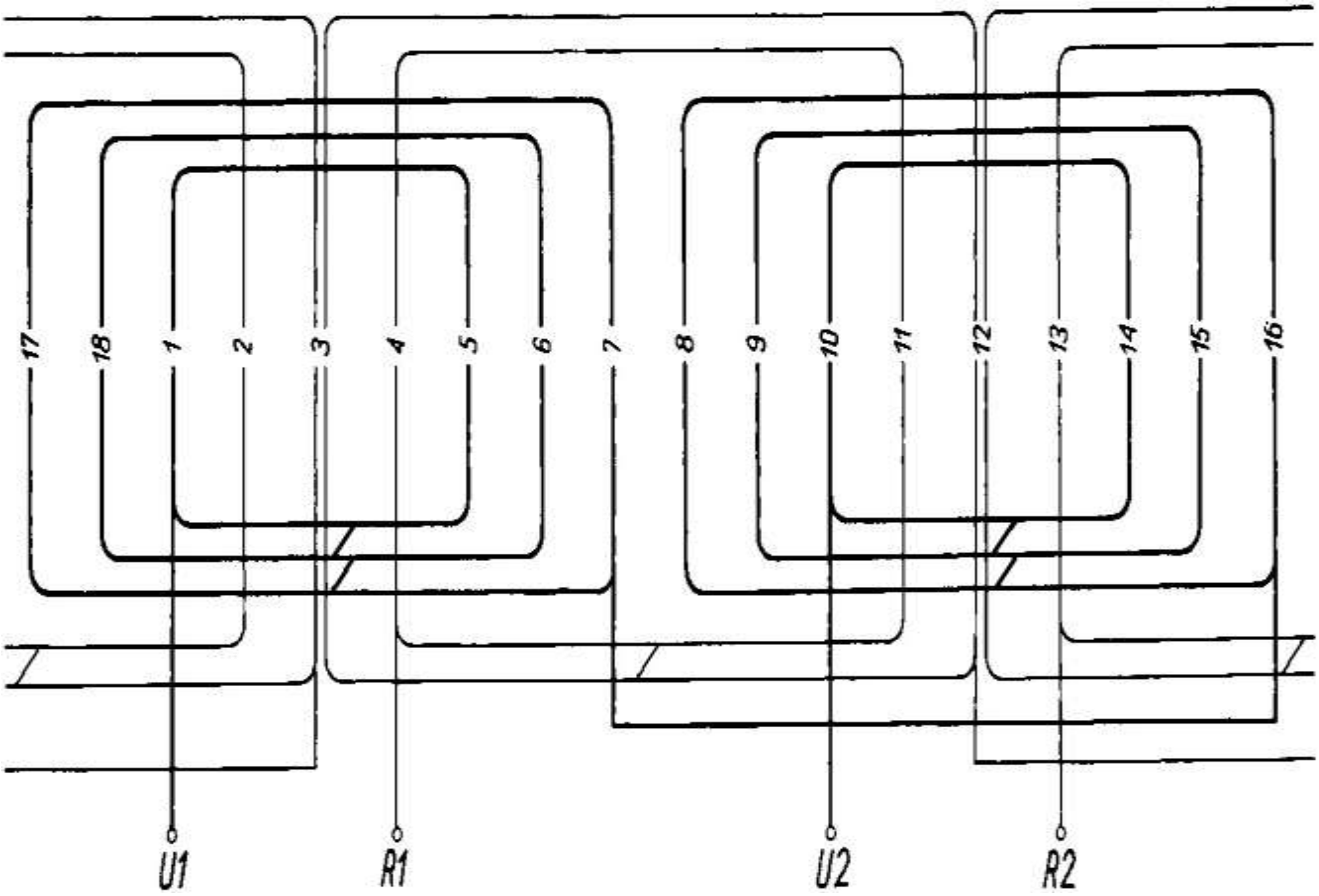

Figure. 162. Unbalanced Two-Tier Single-Phase Winding with Shared Slots
Slots = 18; Poles = 2; y_1= 4, 6, 8; y_2 = 7, 9; q_1 = 6; q_2 = 3

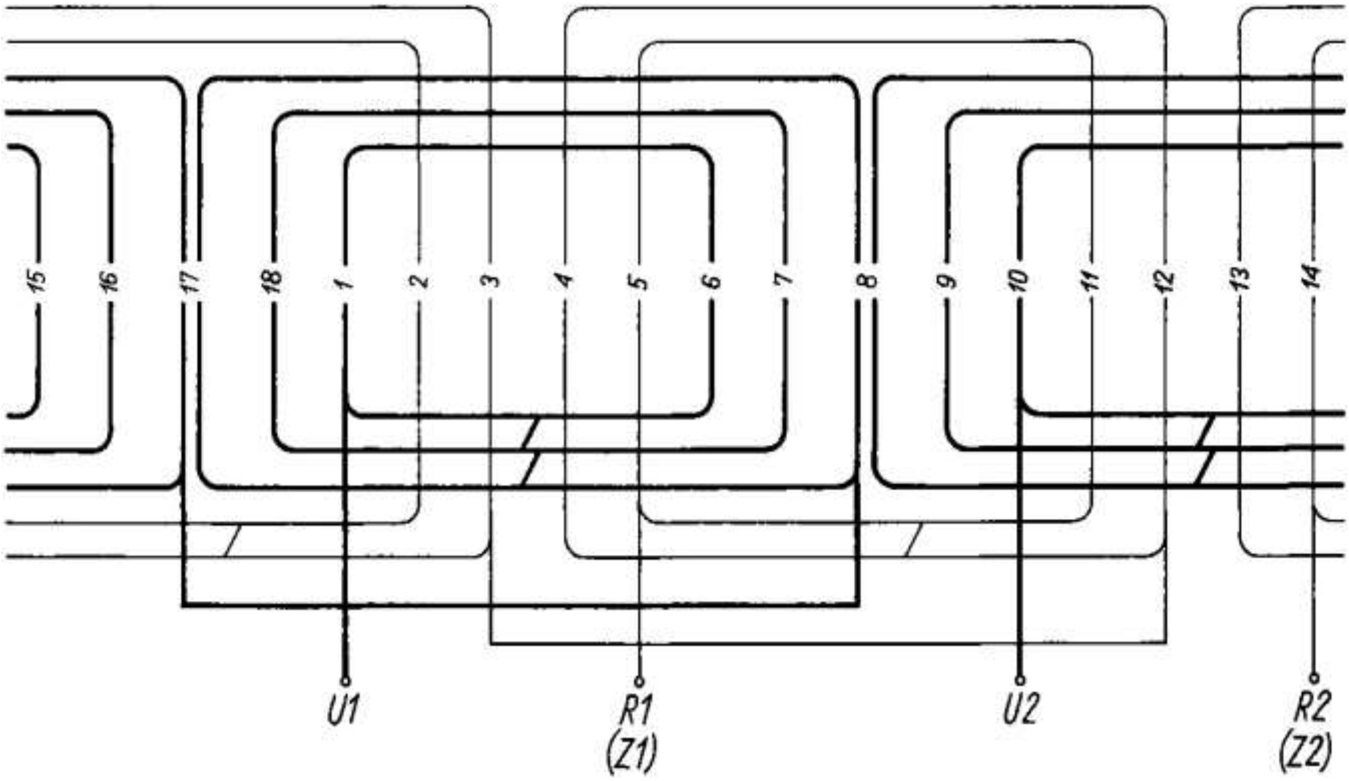

Figure. 163. Unbalanced Two-Tier Single-Phase Winding with Shared Slots
Slots = 18; Poles = 2; y_1 = 5, 7, 9; y_2 = 6, 8; q_1 = 5; q_2 = 4

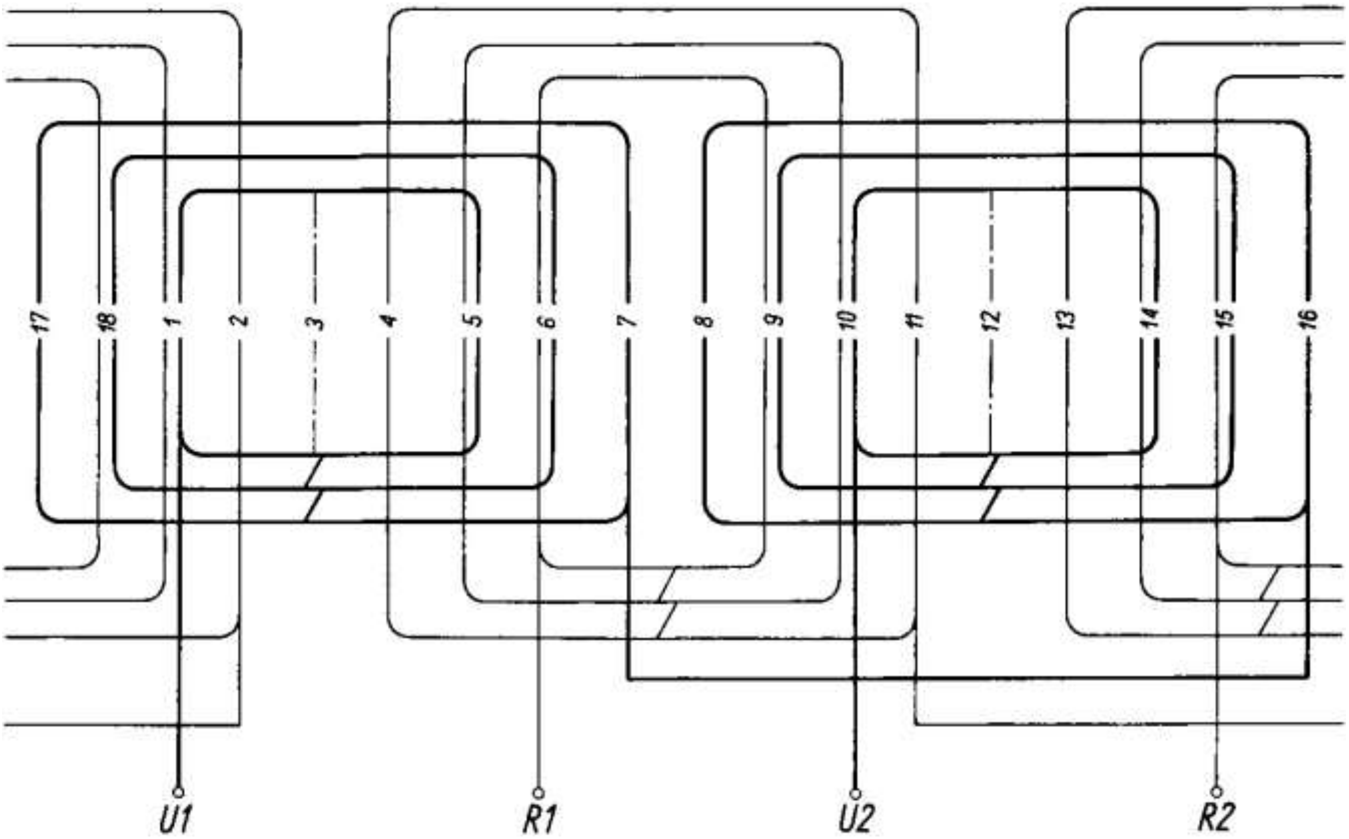

Figure. 164. Sine wave, Two Tier, Single Phase Winding
Slots = 18; Poles = 2; y_1= 4, 6, 8; y_2 = 3, 5, 7; q_1=6; q_2 = 6

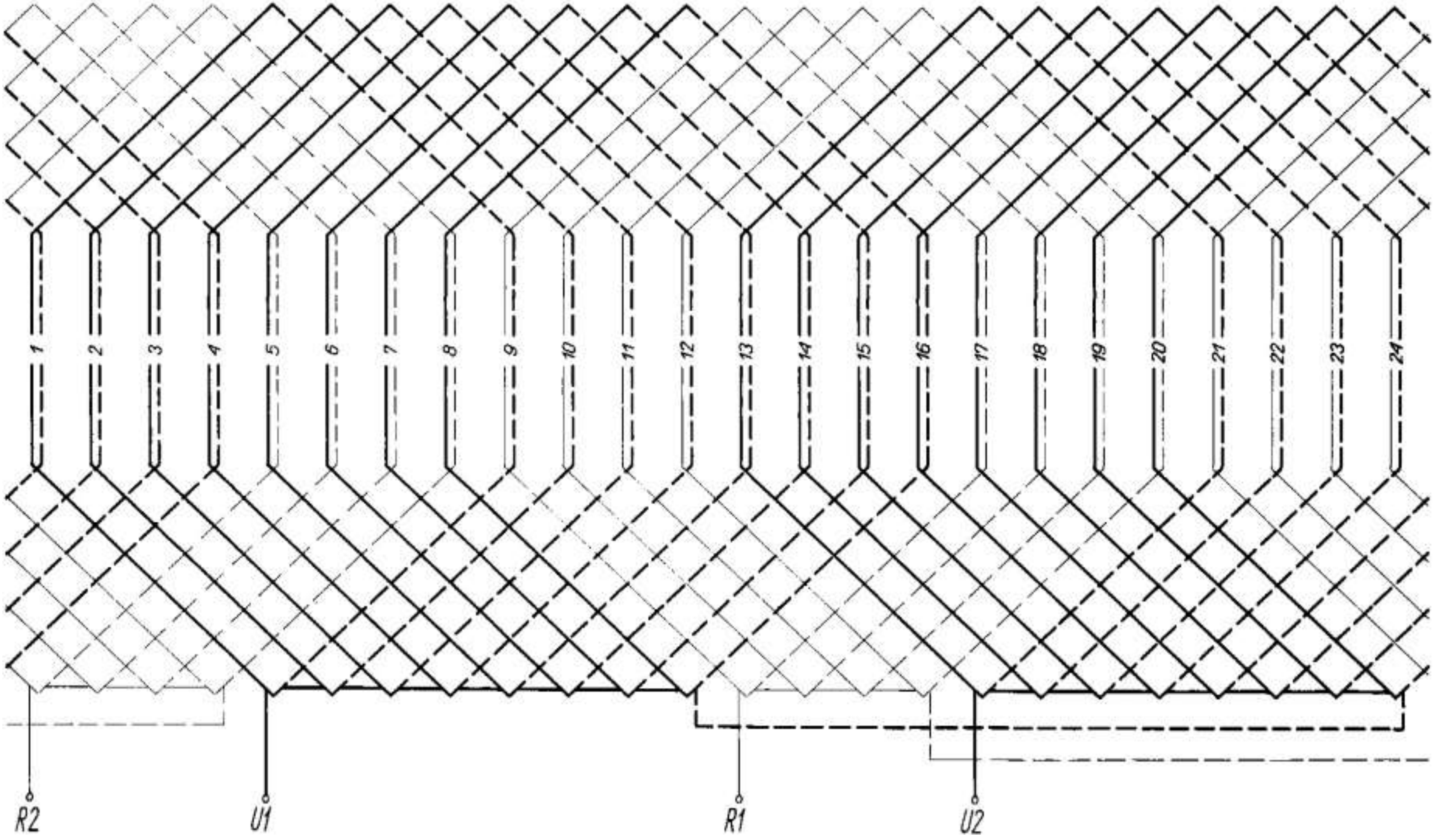

Figure. 165. Double-Layer Single Phase Winding with odd Groupings
Slots = 24; Poles = 2; y = 8; q_1 = 8; q_2 = 4

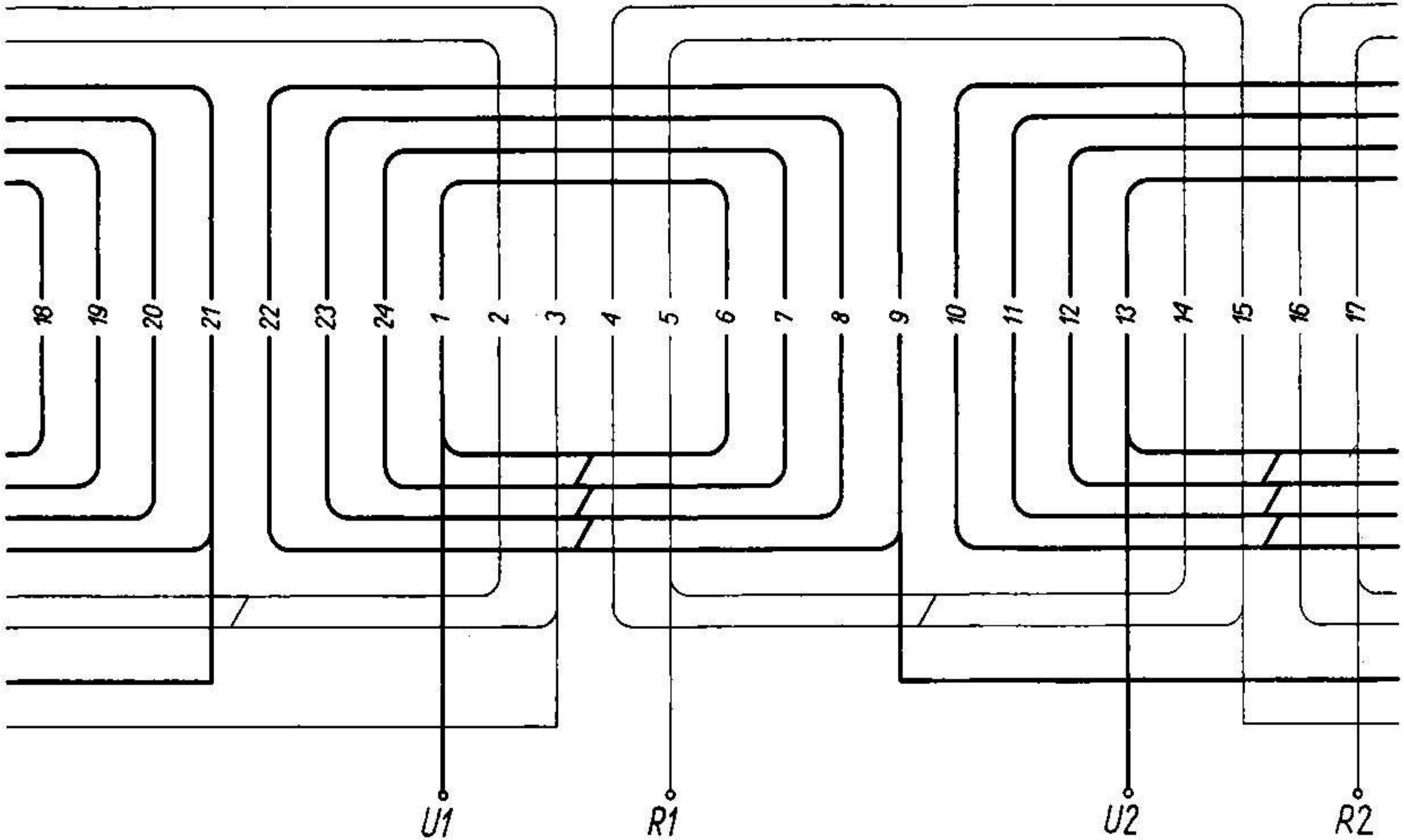

Figure. 166. Unbalanced Two-Tier Single-Phase Winding
Slots = 24; Poles = 2; y_1 = 5, 7, 9, 11; y_2 = 9, 11; q_1 = 8; q_2 = 4

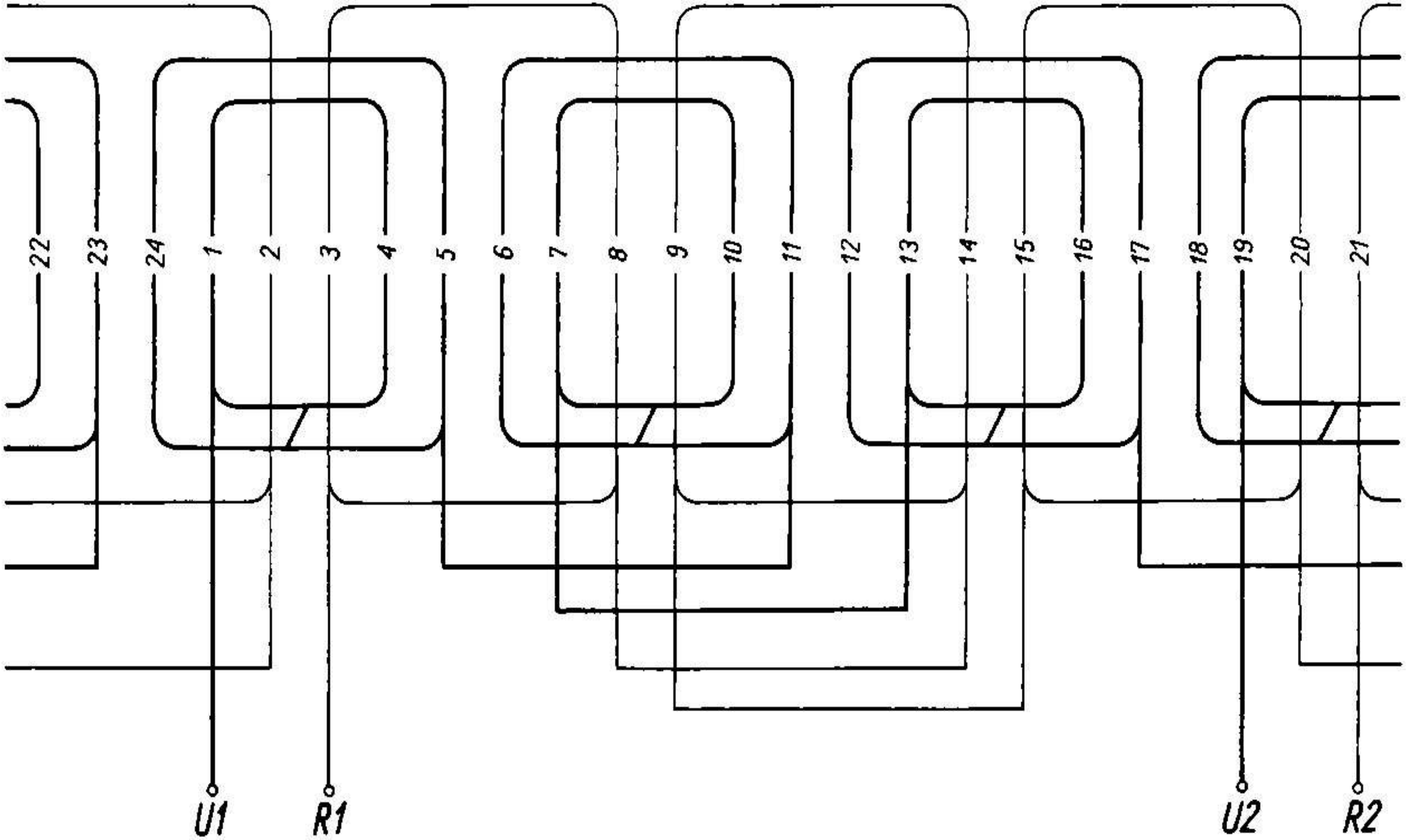

Figure. 167. Unbalanced Two-Tier Single-Phase Winding
Slots = 24; Poles = 4; $y_1 = 3, 5$; $y_2 = 5$; $q_1 = 4$; $q_2 = 2$

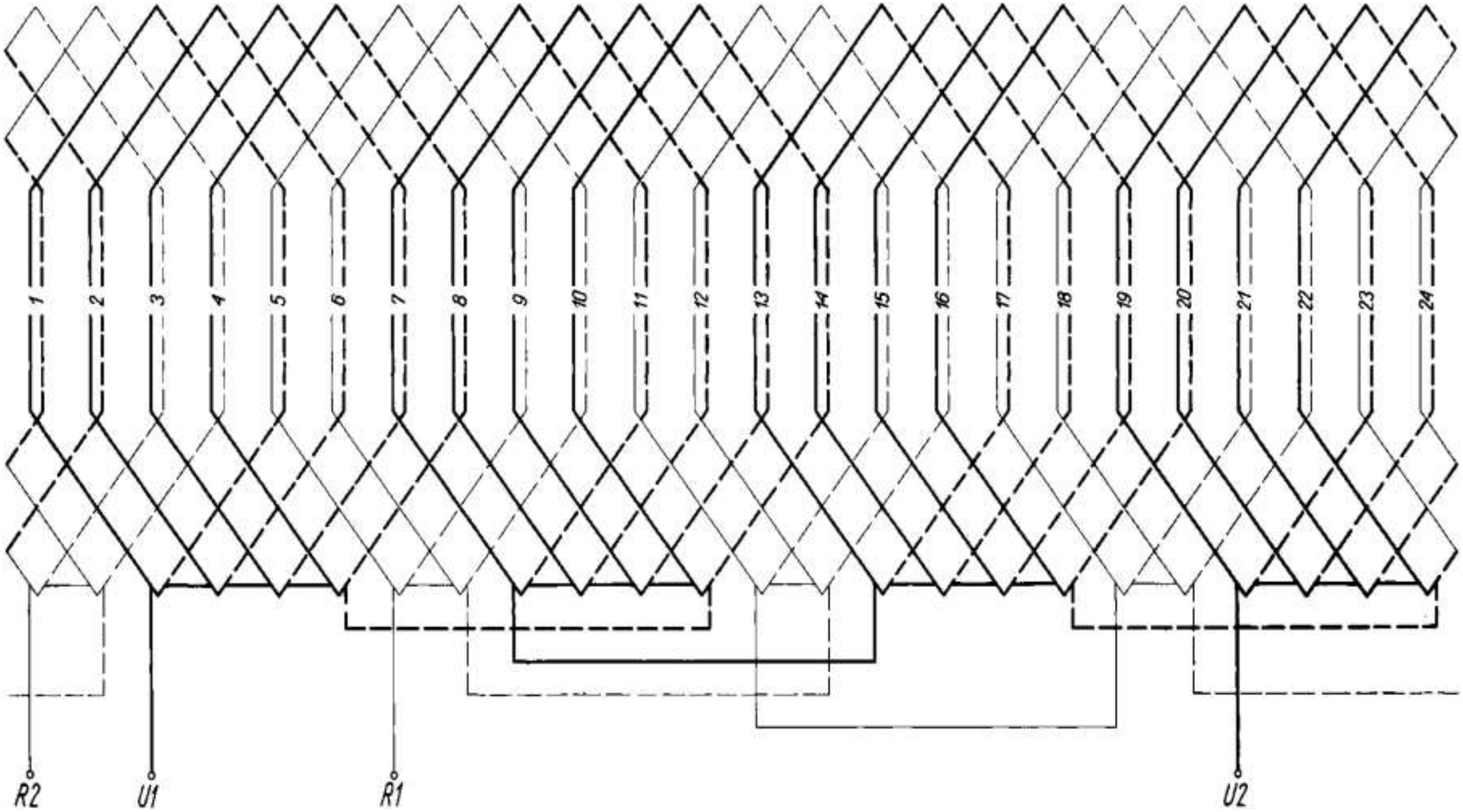

Figure. 168. Unbalanced Double-Layer Single Phase Winding
Slots = 24; Poles = 4; y = 4; q_1=4; q_2 = 2

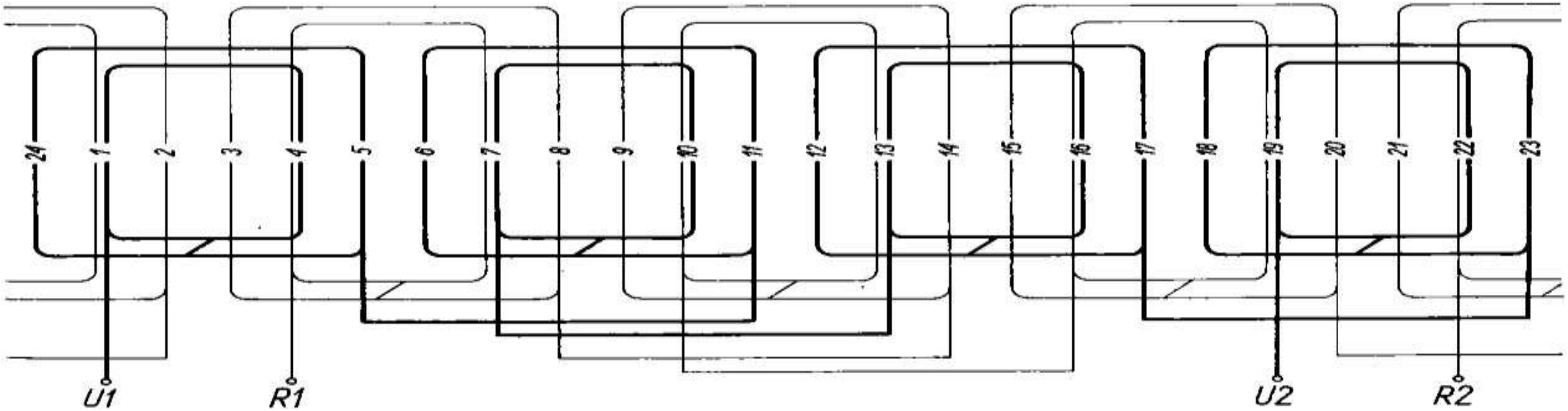

Figure. 169. Sine wave, Two Tier, Single Phase Winding
Slots = 24; Poles = 4; y = 3, 5; q = 4

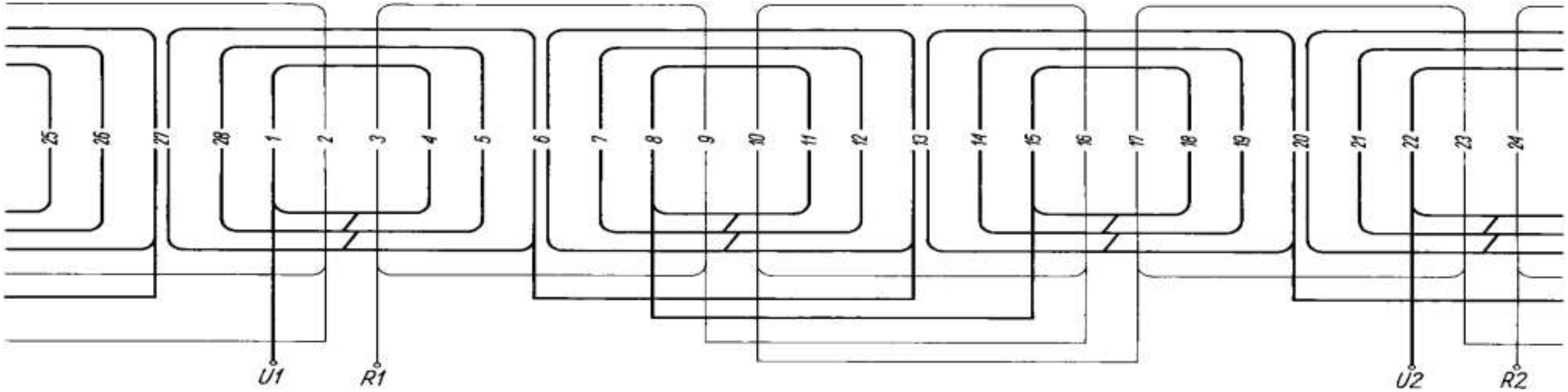

Figure. 170. Unbalanced Two-Tier Single-Phase Winding
Slots = 28; Poles = 4; y_1 = 3, 5, 7; y_2 = 6; q_1 = 5; q_2 = 2

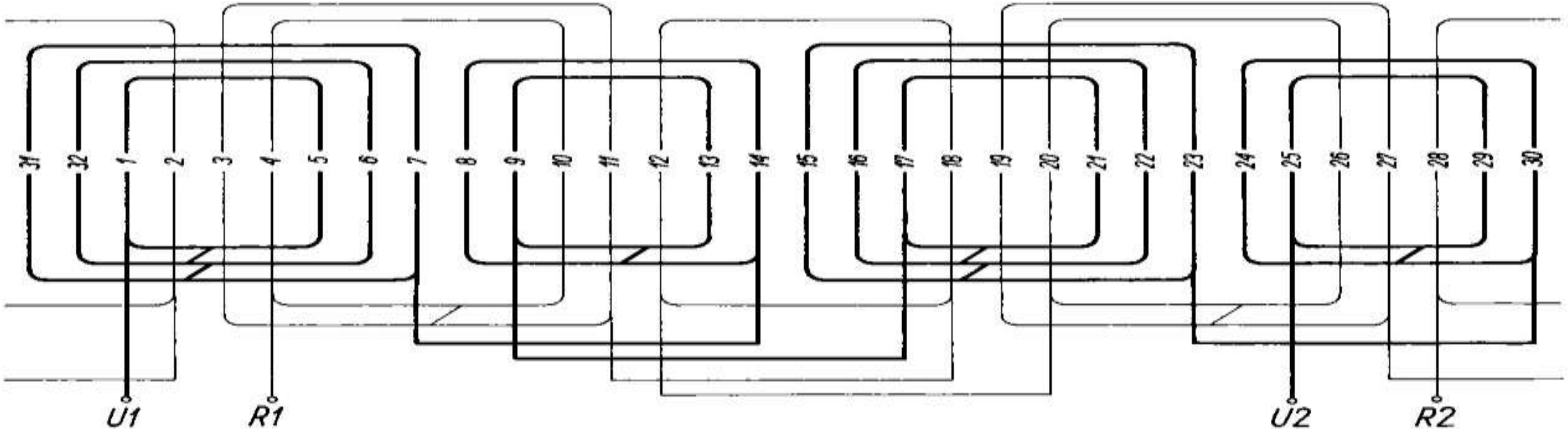

Figure. 171. Unbalanced Two-Tier Single-Phase Winding
Slots = 32; Poles = 4; y_1 = 4, 6, 8; y_2 = 6, 8; q_1 = 5; q_2 = 3

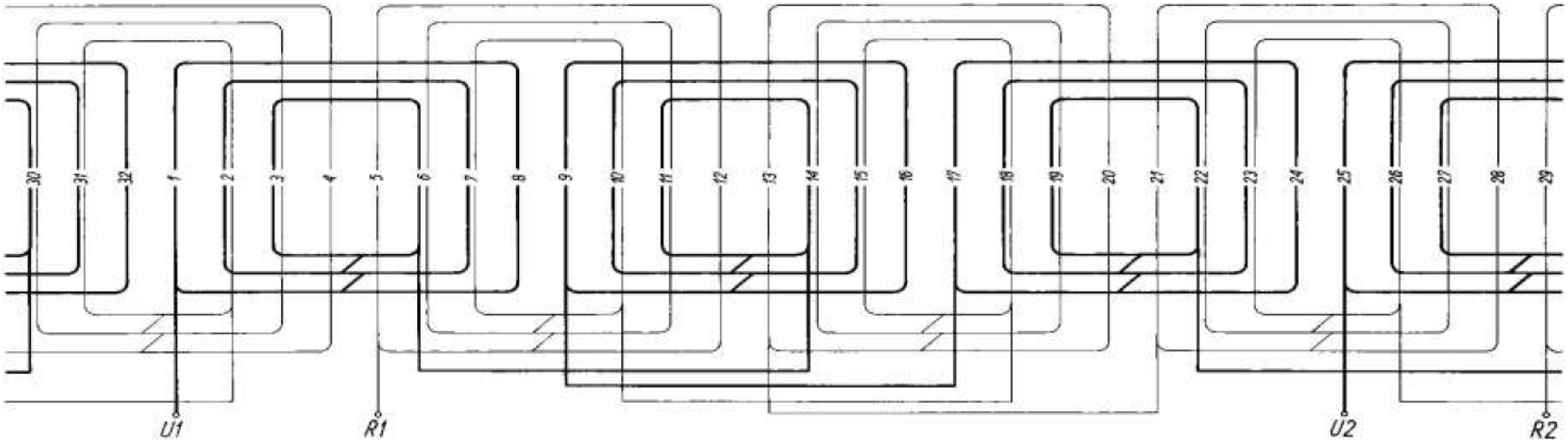

Figure. 172. Sine wave, Two-Tier, Single Phase Winding

Slots = 32; Poles = 4; y = 3, 5, 7; q = 6

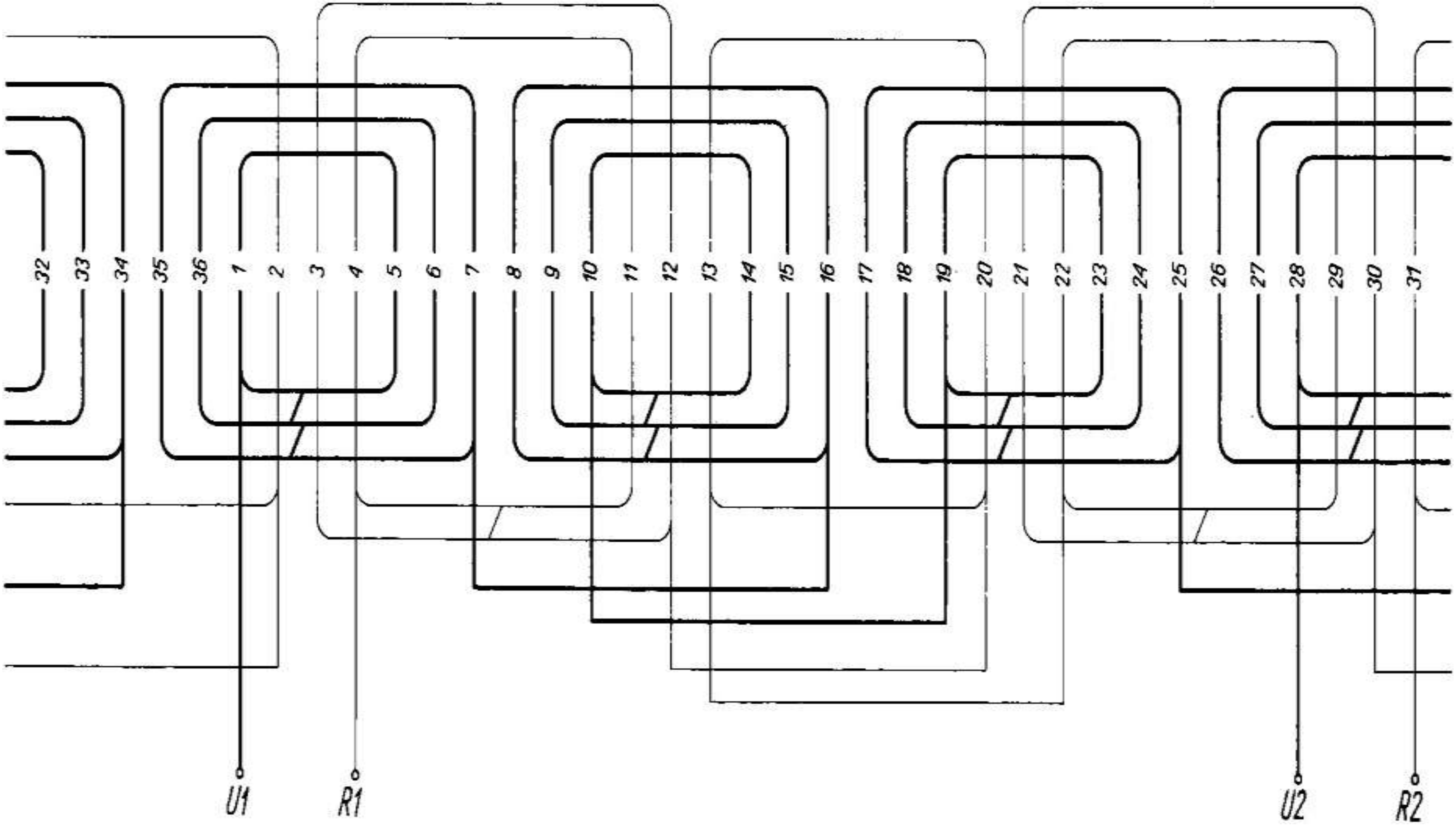

Figure. 173. Unbalanced Two-Tier Single-Phase Winding
Slots = 36; Poles = 4; y_1 = 4, 6, 8; y_2 = 7, 9; q_1 = 6; q_2 = 3

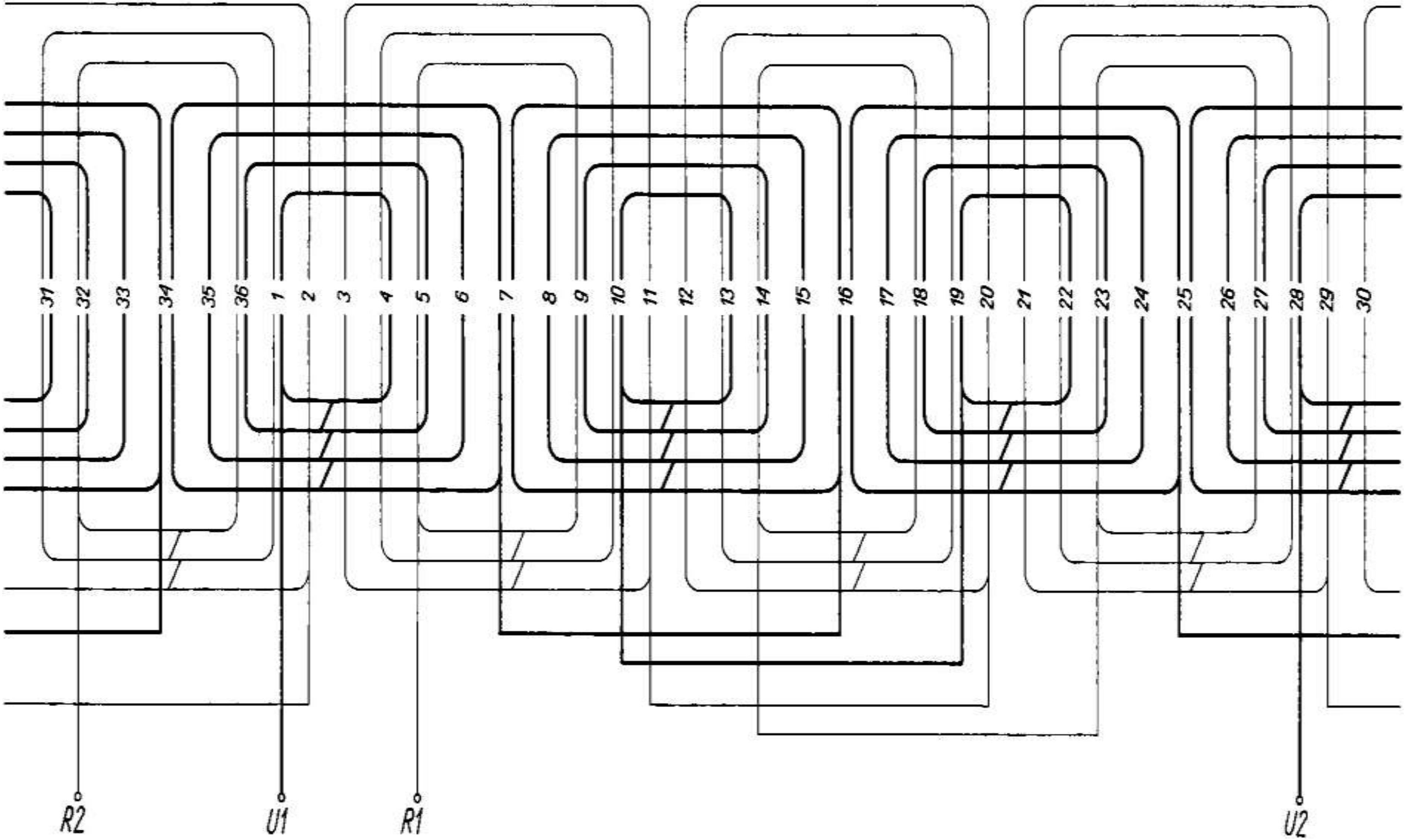

Figure. 174. Sine wave, Two Tier, Single Phase Winding
Slots = 36; Poles = 4; y_1 = 3, 5, 7, 9; y_2 = 4, 6, 8; q_1 = 7; q_2 = 6

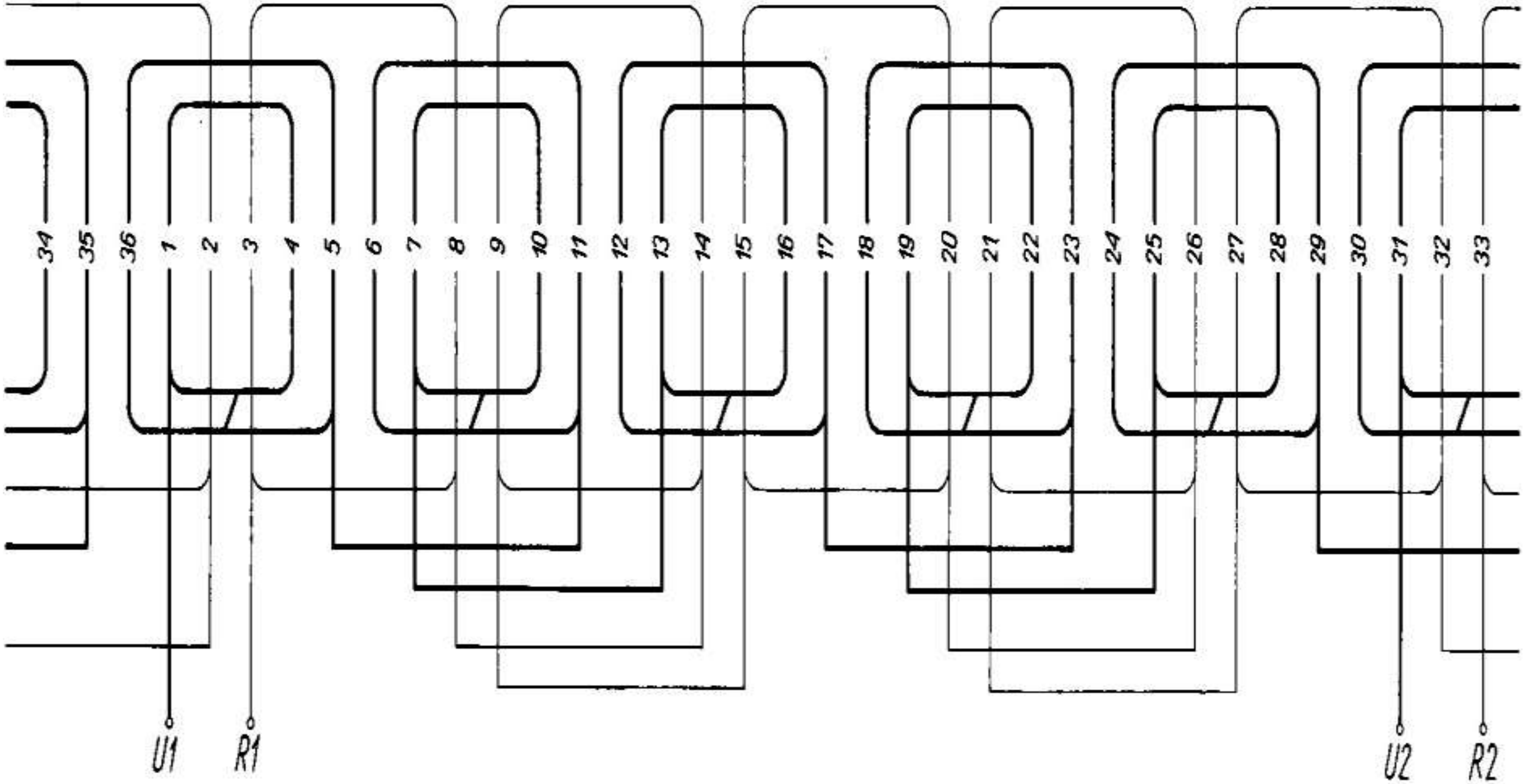

Figure. 175. Unbalanced Two-Tier Single-Phase Winding
Slots = 36; Poles = 6; y_1 = 3, 5; y_2 = 5; q_1 = 4; q_2 = 2

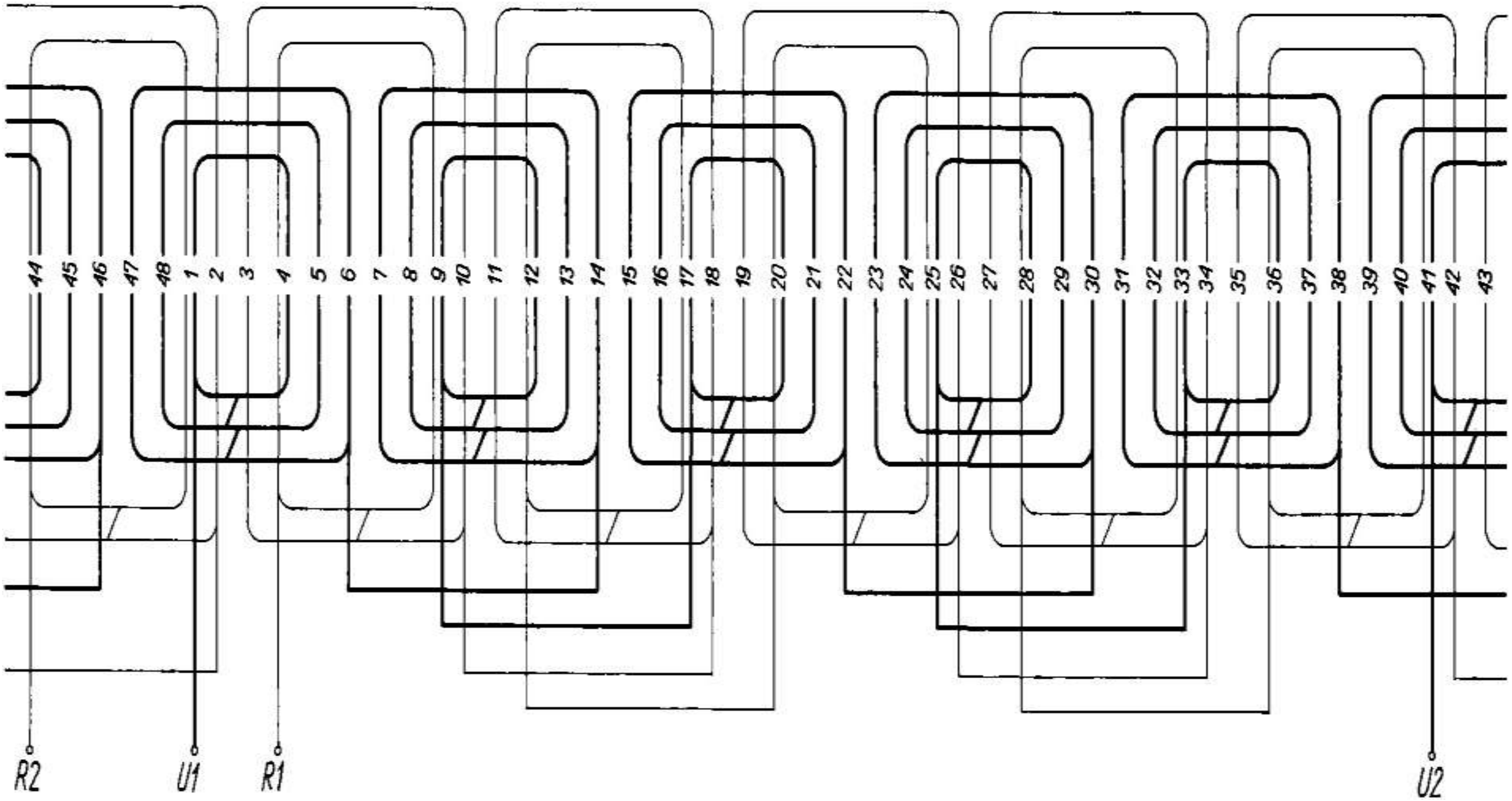

Figure. 176. Sine wave, Two Tier, Single Phase Winding
Slots = 48; Poles = 6; y_1 = 3, 5, 7; y_2 = 5, 7